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Bosch Group

Rexroth RD 500 Accessories

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Functional Description

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Accessories

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- to the accessories
- to the mechanically installation of the units
- to the electrical installation of the units
- for operation

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Validity The data specified above only serve to describe the product. No statements concerning a certain condition or suitablility for a certain application can be derived from our information. The given information does not release the user from the obligation of own judgement and verification. It must be remembered that our products are subject to a natural process of wear and aging.

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1 Safety Instructions for Electric Servo Drives and Controls

1.1 Introduction

Read these instructions before the equipment is used and eliminate the risk of personal injury or property damage. Follow these safety instructions at all times.

Do not attempt to install, use or service this equipment without first reading all of the documentation provided with the product. Read and understand these safety instructions and all user documentation of the equipment prior to working with the equipment at any time. If you do not have the user documentation for your equipment contact your local Bosch Rexroth representative to send this documentation immediately to the person or persons responsible for the safe operation of this equipment.

If the product is resold, rented, transferred or passed on to others, then these safety instructions must be delivered with the product.

WARNING

Inappropriate use of this equipment, failure to follow the safety instructions in this document or tampering with the product, including disabling of safety devices, may result in product damage, personal injury, severe electrical shock or death!

1.2 Explanations

The safety warnings in this documentation describe individual degrees of hazard seriousness in compliance with ANSI:

Warning symbol with text	Degree of hazard seriousness The degree of hazard seriousness describes the consequences resulting from non-compliance with the safety guidelines:
 **DANGER**	Bodily harm or product damage will occur.
 **WARNING**	Death or severe bodily harm may occur.
 **CAUTION**	Death or severe bodily harm may occur.

Fig. 1-1:Classes of danger according to ANSI

1.3 Hazards due to inappropriate use

DANGER

High voltage and high discharge current! Danger to life, risk of severe electrical shock and risk of injury!

DANGER

Dangerous movements! Danger to life and risk of injury or equipment damage by unintentional motor movements!

WARNING

High electrical voltage due to wrong connections! Danger to life, severe electrical shock and severe bodily injury!

WARNING

Health hazard for persons with heart pacemakers, metal implants and hearing aids in proximity to electrical equipment!

CAUTION

Surface of machine housing could be extremely hot! Danger of injury! Danger of burns!

CAUTION

Risk of injury due to inappropriate handling! Bodily injury caused by crushing, shearing, cutting and mechanical shock or improper handling of pressurized systems!

CAUTION

Risk of injury due to inappropriate handling of batteries!

1.4 General information

- Bosch Rexroth AG is not liable for damages resulting from failure to observe the warnings given in these documentation.
- Read all of the operating, maintenance and safety instructions in your language before starting up the machine. If you find that due to a translation error you can not completely understand the documentation for your product, please ask your supplier to clarify.
- Proper and correct transport, storage, assembly and installation as well as care in operation and maintenance are prerequisites for optimal and safe operation of this equipment.
- Trained and qualified personnel in electrical equipment:
  Only trained and qualified personnel may work on this equipment or in its proximity. Personnel are qualified if they have sufficient knowledge of the assembly, installation and operation of the product as well as an understanding of all warnings and precautionary measures noted in these instructions.
  Furthermore, they should be trained, instructed and qualified to switch electrical circuits and equipment on and off, to ground them and to mark them according to the requirements of safe work practices and common sense. They must have adequate safety equipment and be trained in first aid.
- Only use spare parts and accessories approved by the manufacturer.
- Follow all safety regulations and requirements for the specific application as practiced in the country of use.
- The equipment is designed for installation on commercial machinery.

European countries: see directive 89 / 392 / EC (Machinery Directive)

- The ambient conditions specified in the product documentation must be observed.
- Use only safety features that are clearly and explicitly approved in the Project Planning manual.
  For example, the following areas of use are not allowed: Cranes and hoisting equipment, elevators used for people or freight, devices and vehicles to transport people, medical applications, refinery plants, the transport of hazardous goods, radioactive or nuclear applications, applications sensitive to high frequency, mining, control of protection equipment (also in a machine).
- Start-up is only permitted once it is ensured that the machine, in which the product is installed, complies with the requirements of national safety regulations and safety specifications of the application.
- Operation is only permitted if the national EMC regulations for the application are met.

The machine builder is responsible for compliance with the limiting values as prescribed in the national regulations and specific EMC regulations for the application.

European countries: see Directive 89/336/EC (EMC Directive).

US.: Refer to the National Electrical Code (NEC), National Electrical Manufacturers Association (NEMA), and local building codes. The user of this equipment must observe the above noted items at all times.

- Technical data, connections and operational conditions are specified in the product documentation and must be followed at all times.

1.5 Protection against contact with electrical parts

Note: This section refers to equipment with voltages above 50 Volts.

Making contact with parts at voltages above 50 Volts could be dangerous to personnel and cause an electrical shock. When operating electrical equipment, it is unavoidable that some parts of the unit conduct dangerous voltages.

DANGER

High electrical voltage! Danger to life, severe electrical shock and severe bodily injury!

⇒ Only those trained and qualified to work with or on electrical equipment are permitted to operate, maintain or repair this equipment.

⇒ Follow general construction and safety regulations when working on electrical installations.

⇒ Before powering-up, the productive conductor must be permanently connected to all electrical units according to the connection diagram.

⇒ Do not operate electrical equipment at any time if the protective conductor is not permanently connected, even for brief measurements or tests.

⇒ Before working with electrical parts with voltage potentials higher than 50 V, the equipment must be disconnected from the line supply or power supply.

⇒ The following should be observed with electrical drives, power supplies, and filter components:

Wait five (30) minutes after switching off power to allow capacitors to discharge before beginning work. Measure the voltage at the capacitors before beginning work to make sure that the equipment is safe to touch.

⇒ Never touch the electrical connection points of a component while power is turned on.

⇒ Install the covers and guards provided with the equipment properly before switching the equipment on. Prevent contact with live parts at any time.

⇒ A residual-current-operated protective device (r.c.d.) must not be used on an electric drive! Indirect contact may be prevented by other means, for example, by an overcurrent protective device.

⇒ Equipment that is built into machines must be secured against direct contact. Use appropriate housings, for example a control cabinet.

European countries: according to EN 50178/1998, section 5.3.2.3.

US: Refer to the National Electrical Code (NEC), National Electrical Manufacturers Association (NEMA) and local building codes. The user of this equipment must observe the above noted instructions at all times.

To be observed for electric drives and filter components:

DANGER

High voltage! High leakage current! Danger to life, danger of injury and bodily harm from electrical shock!

⇒ Before powering-up all housings and motors must be permanently grounded according to the connection diagram. This applies even for brief tests.

⇒ The protective conductor of the electrical equipment must be permanently connected to the line supply. The leakage current is greater than 3.5 mA.

⇒ Use a copper conductor with at least 10 mm² cross section over its entire course for this protective connection!

⇒ Prior to startups, even for brief tests, always connect the protective conductor or connect with ground wire. High voltage levels can occur on the housing that could lead to severe electrical shock and personal injury.

European countries: EN 50178 / 1998, Section 5.3.2.1.

US: Refer to the National Electrical Code (NEC), National Electrical Manufacturers Association (NEMA), and local building codes. The user of this equipment must observe the above noted instructions at all times.

1.6 Protection against electrical shock by protective low voltage (PELV)

All connections and terminals with voltages between 5 and 50 Volts on Bosch Rexroth products are protective low voltages designed in accordance with the following Standards:

- International: IEC 60364-4-41
- EU countries: Refer to EN 50178 / 1998, Section 5.2.8.1.

WARNING

High voltage due to wrong connections! Danger to life, severe electrical shock and severe bodily injury!

⇒ Only equipment, electrical components and cables of the protective low voltage type (PELV = Protective Extra Low Voltage) may be connected to all terminals and connections with 0 to 50 Volts.

⇒ Only safely isolated voltages and electrical circuits may be connected. Safe isolation is achieved, for example, with an isolating transformer, a safe opto-electronic coupler or when battery-operated.

1.7 Protection against dangerous movements

Dangerous movements can be caused by faulty control or the connected motors. There are various causes:

- unclean or wrong wiring of cable connections
- inappropriate or wrong operation of equipment
- malfunction of sensors, encoders and monitoring circuits
- defective components
- software errors

Dangerous movements can occur immediately after equipment has been powered-up or even after an unspecified time of trouble-free operation.

The monitors in the drive components make faulty operation almost impossible. Regarding personnel safety, especially the danger of bodily harm and property damage, this alone should not be relied upon to ensure complete safety. Until the built-in monitors become active and effective, it must be assumed in any case that some faulty drive movements will occur. The extent of these faulty drive movements depends on the type of control and the state of operation.

DANGER

Dangerous movements! Danger to life and risk of injury or equipment damage!

⇒ Personnel protection must be secured for the above listed reason by means of superordinate monitors or measures.

These are implemented in accordance with the specific situation of the plant / system and a danger and fault analysis conducted by the manufacturer of the plant / system. All the safety regulations that apply to this plant/system are included. By switching off, circumventing or if safety devices have simply not been activated, then random machine movements or other types of faults can occur.

Avoiding accidents, injury or property damage:

⇒ Keep free and clear of the machine's range of motion and moving parts. Prevent people from accidentally entering the machine's range of movement:

- use protective fences
- use protective railings
- install protective coverings
- install light curtains or light barriers

⇒ Fences must be strong enough to withstand maximum possible momentum.

⇒ Mount the emergency stop switch (E-stop) in the immediate reach of the operator. Verify that the emergency stop works before startup. Don't operate the machine if the emergency stop is not working.

⇒ Isolate the drive power connection by means of an emergency stop circuit or use a start-inhibit system to prevent unintentional start-up.

⇒ Make sure that the drives are brought to standstill before accessing or entering the danger zone.

⇒ Secure vertical axes against falling or slipping after switching off the motor power by, for example:

- Mechanically securing the vertical axes
- Adding an external brake / clamping mechanism
- Balancing and thus compensating for the vertical axes weight and the gravitational force

The standard equipment motor brake or an external brake controlled directly by the servo drive are not sufficient to guarantee the safety of personnel!

⇒ Disconnect electrical power to the equipment using a master switch and lock-out the switch against reclosure:

- for maintenance and repair work
- for cleaning of equipment
- if the equipment is not used for long periods of time

⇒ Avoid operating high-frequency, remote control and radio equipment near electronic circuits and feeder cables. If use of such equipment cannot be avoided, verify the system and the plant for possible malfunctions at all possible positions of normal use before the first start-up. If necessary, perform a special electromagnetic compatibility (EMC) test on the plant.

1.8 Protection against magnetic and electromagnetic fields during operations and mounting

Magnetic and electromagnetic fields generated by current-carrying conductors and permanent magnets in motors represent a serious health hazard to persons with heart pacemakers, metal implants and hearing aids.

WARNING

Health hazard for persons with heart pacemakers, metal implants and hearing aids in proximity to electrical equipment!

⇒ Persons with pacemakers, metal implants and hearing aids are not permitted to enter following areas:

- Areas in which electrical equipment and parts are mounted, being operated or started up.
- Areas in which parts of motors with permanent magnets are being stored, operated, repaired or mounted.

⇒ If it is necessary for a person with a pacemaker to enter such an area, then a physician must be consulted prior to doing so. Pacemakers, that are already implanted or will be implanted in the future, have a considerable deviation in their immunity to interference. Due to the unpredictable behavior there are no generally valid rules.

⇒ Persons with hearing aids, metal implants or metal pieces must consult a doctor before they enter the areas described above. Otherwise health hazards will occur.

1.9 Protection against contact with hot parts

CAUTION

Housing surfaces could be extremely hot! Danger of injury! Danger of burns!

⇒ Do not touch surfaces near the source of heat! Danger of burns!

⇒ Wait ten (10) minutes before you access any hot unit. Allow the unit to cool down.

⇒ Do not touch hot parts of the equipment, such as housings, heatsinks or resistors. Danger of burns!

1.10 Protection during handling and installation

Under certain conditions inappropriate handling and installation of parts and components may cause injuries.

CAUTION

Risk of injury through incorrect handling! Bodily harm caused by crushing, shearing, cutting and mechanical shock!

- ⇒ Observe general instructions and safety regulations during handling installation.
- ⇒ Use only appropriate lifting or moving equipment.
- ⇒ Take precautions to avoid pinching and crushing.
- ⇒ Use only appropriate tools. If specified by the product documentation, special tools must be used.
- ⇒ Use lifting devices and tools correctly and safely.
- ⇒ Wear appropriate protective clothing, e.g. safety glasses, safety shoes and safety gloves.
- ⇒ Never stay under suspended loads.
- ⇒ Clean up liquids from the floor immediately to prevent personnel from slipping.

1.11 Battery safety

Batteries contain reactive chemicals in a solid housing. Inappropriate handling may result in injuries or equipment damage.

CAUTION

Risk of injury through incorrect handling!

- ⇒ Do not attempt to re-activate discharged batteries by heating or other methods (danger of explosion and corrosion).
- ⇒ Never charge batteries (danger from leakage and explosion).
- ⇒ Never throw batteries into a fire.
- ⇒ Do not dismantle batteries.
- ⇒ Handle with care. Incorrect withdrawal or installation of a battery can damage equipment.

Note: Environmental protection and disposal! The batteries contained in the product should be considered as hazardous material for land, air and sea transport in the sense of the legal requirements (danger of explosion). Dispose of batteries separately from other refuse. Observe the legal requirements given in the country of installation.

1.12 Protection against pressurized systems

Certain Motors (ADS, ADM, 1MB etc.) and drives, corresponding to the information in the Project Planning manual, must be provided with various media at a high pressure such as compressed air, hydraulic oil, cooling fluid or coolant. In these cases, improper handling of the supply of the pressurized systems or connections of the fluid or air under pressure can lead to injuries or accidents.

CAUTION

Danger of injury when pressurized systems are handled by untrained personnel!

⇒ Do not attempt to disassemble, to open or to cut a pressurized system.

⇒ Observe the operation restrictions of the respective manufacturer.

⇒ Before the disassembly of pressurized systems, lower pressure and drain off the fluid or gas.

⇒ Use suitable protective clothing (for example protective eyewear, safety shoes and gloves)

⇒ Remove any fluid that has leaked out onto the floor immediately.

Note: Environmental protection and disposal! The fluids used in the operation of the pressurized system equipment is not environmentally compatible. Fluid that is damaging to the environment must be disposed of separately from normal waste. Observe the national specifications of the country of installation.

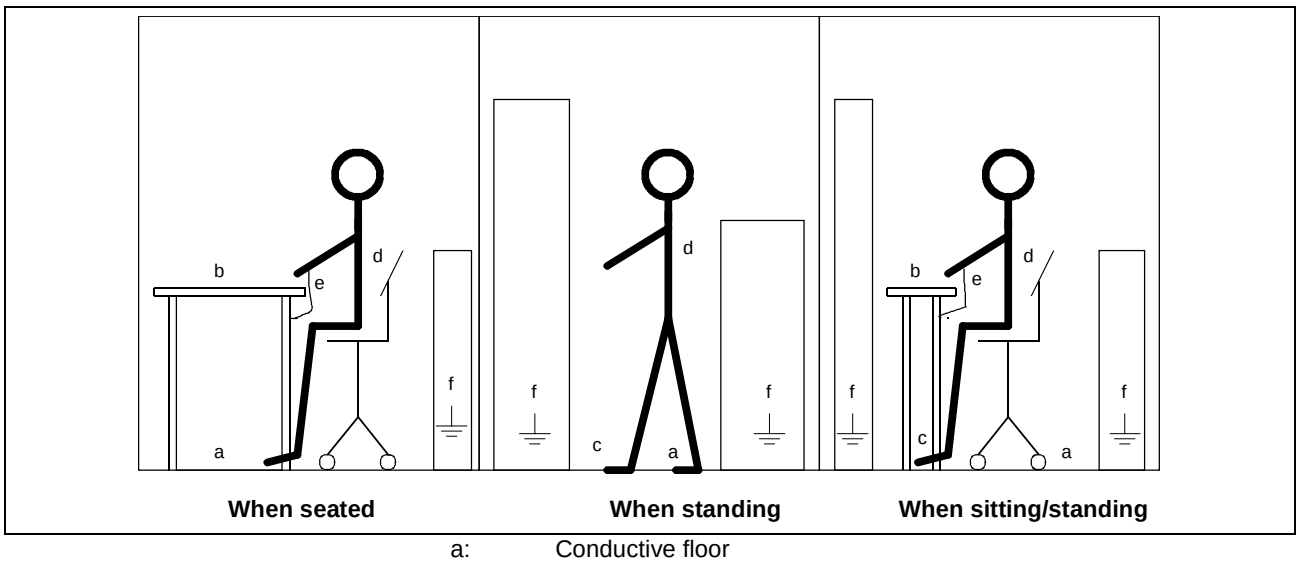
1.13 Precautionary measures when handling components which can be destroyed by electrostatic discharge (ESDS)

The drive units contain components and parts which can be destroyed by electrostatic discharge. Please observe the following when working with electronic modules and boards:

- Electronic modules and boards should only be touched if absolutely necessary.
- Before touching an electronic module/board, the human body must first be electrically discharged.
- Electronic modules/boards may not come into contact with highly-insulating materials (e.g. plastic foils, insulating work surfaces, articles of clothing manufactured from man-made fiber).
- Electronic modules/boards may only be placed on conductive surfaces.
- The soldering iron tip must be grounded when carrying-out soldering work on electronic modules / boards.

- Electronic modules / boards and components may only be stored and shipped in conductive packaging (e.g. metalized plastic or metal containers).
- If the packaging is not conductive, electronic modules/boards must be wrapped in a conductive material. In this case, e.g. conductive foam rubber or household aluminum foil can be used.

The necessary ESDS protective measures are clearly shown in the following diagram:



a: Conductive floor
b: ESDS table
c: ESDS shoes
d: ESDS overall
e: ESDS bracelet
f: Grounding connection of the cabinets

Fig. 1-2: ESDS protective measures

2 Important Notes Regarding Use

2.1 Proper Use

Introduction

Bosch Rexroth products are developed and manufactured according to the state of the art. Before they are delivered, they are inspected to ensure that they operate safely.

The products may only be used in the proper manner. If they are not used in the proper manner, situations may arise that result in damage to material and personnel.

Note: As the manufacturer, Bosch Rexroth in no way provides a guarantee, responsibility or compensation for damages in the case of improper use of the products; the risks in the case of improper use of the products are borne solely by the user.

Before you put Bosch Rexroth products into operation, the following requirements must be fulfilled to ensure proper use of the products:

- Everyone who in any way deals with one of our products must read and understand the corresponding notes regarding safety and regarding proper use.
- If the products are hardware, they must be kept in their original state, i.e. no constructional modifications may be made. Software products may not be decompiled; their source codes may not be modified.
- Damaged or improperly working products must not be installed or put into operation.
- It must be ensured that the products are installed according to the regulations listed in the documentation.

Areas of Use and Application

Bosch Rexroth accessories may be operated only in connection with converters and inverters of the RD 500 series.

Note: The accessories and add-ons may be used only with RD 500 drive control devices. Components that are not explicitly mentioned may be neither attached nor connected. The same is true for cables and lines. Operation may be carried out only in the explicitly mentioned configurations and combinations of the component and with the software and firmware specified in the corresponding description of functions.

The accessories may be operated only under the assembly and installation requirements given in this documentation, in the given position of use and under the given ambient conditions (ambient temperatures, protective class, humidity, EMC, etc.

2.2 Improper Use

Use of the accessories outside of the areas of application listed above or under operating conditions other than those described in the documentation or in the Technical Data is viewed as "improper use".

The accessories my not be used if they...

- ... are exposed to operating conditions that do not fulfill the prescribed ambient conditions. For example, operation under water, under extreme variations in temperature or under extreme maximum temperatures is prohibited.
- In addition, the accessories may not be used in applications that are not explicitly released by Bosch Rexroth. In this regard, it is required that you refer to the statements in the general notes regarding safety!

3 RZC01.2 Chemistry module

3.1 Description Chemistry module

The Chemistry module supplements AC drive converters, which are manufactured in large series, by the requirement for the chemical and process industries. This is realized both as far as the space is concerned and electrically. The AC drive converters and Chemistry module have the same housing dimensions. As a result of the "book-type" housing, they can be mounted in-line without any intermediate clearance. As the Chemistry modules have the same height and width, when mounted in cabinets, they can be located above, below or also to the side of the AC drive converter.

Technical Characteristics

The Chemistry module corresponds to NAMUR recommendation NE 37 for the design of AC drive converters and the standard terminal strip for variable-speed drives. The terminal strip and the associated functions are sub-divided into a standard and an optional part. It is sub-divided into three sections:

- X1 for the power connections
- X2 for signal cables which correspond to the requirements "extra low function voltage with safe separation PELV".
- X3 to connect the PTC thermistor of the motor.

All of the NAMUR recommendations are maintained by the AC drive converters and Chemistry modules from the RD 500 - series:

- The RD 500 series conforms to the "functional extra-low voltage with safe separation (PELV)" regulations in accordance with DIN / VDE 0100 Part 410 and DIN / VDE 0160 Part 101.
- The drive converter comprises a complete package for chassis- or cabinet mounting. This means that the power contactor, line filter and output filter (to limit the voltages at the motor terminals V_{peak} <1000 V and dv / dt <500 V / µs etc.) are included in the scope of supply. All RD 500 devices with Chemistry modules are mounted and completely connected-up and supplied with preassembled cable- and mounting sets. This reduces the wiring costs and potential sources of error and therefore guarantees a short mounting- and commissioning time.
- A terminal (10) is provided for the inputs "on" dynamic and "on / off (steady-state)"; the operating mode is selected by appropriately parameterizing the drive converter.
- Digital inputs are floating.
- Digital outputs are floating, load capacity 24 V DC / 500 mA.
- Analog inputs and outputs are electrically isolated (floating). The conversion relay for the mandatory supply voltage isolation is positively-driven corresponding to EN50205 and EN 60204-1.
- Further, it fulfills the regulations and specifications regarding "functional extra-low voltage with safe separation" (PELV).
- The PTC thermistor tripping unit is PTB certified (PTB 02 ATEX 3162; Ex 02-32149) and is certified for explosion-protected motors.

Type Key

Abbrev. Column →	1	2	3	4	5	6	7	8	9	10	1	2	3	4	5	6	7	8	9	20	1	2	3	4	5	6	7	8	9	30
Example:	R	Z	C	0	1	.	2	-	6	N	-	0	0	5	-	F	-	2	3											

1. Product
1.1 RZC. . . . . .= RZC

2. Line
2.1 1. . . . . = 01

3. Design
3.1 2. . . . . = 2

4. Nominal connecting voltage
4.1 3 x AC 500 V, ±10 %. . . . . = 5
4.2 3 x AC 400 V, ±15 %. . . . . = 6

5. NAMUR-terminal strip ①
5.1 without NAMUR-terminal strip. . . . . = N
5.2 with NAMUR-terminal strip. . . . . = T

6. Rated power data of frequency converter (kw)
6.1 1,1...4. . . . . = 005
6.2 5,5. . . . . = 007
6.3 7,5. . . . . = 011
6.4 15. . . . . = 018
6.5 18,5. . . . . = 022
6.6 30. . . . . = 037
6.7 37. . . . . = 045 ②

7. Additional function
7.1 24 V Stand-by-power external with filter current feedback. . . . . = F

8. System of protection
8.1 prepared for IP23 cabinet mounting . . . . . .= 23
8.2 prepared for IP54 cabinet mounting . . . . . .= 54

9. Standard reference

Standard	Title	Addition
DIN EN 60529	Degrees of protection provided by enclosures (IP-code) (IEC 60529:1989 + A1:1999); German version EN 60529:1991 + A1:2000	2000-09

Note:
① Without NAMUR-terminal strip:
Frequency converter RD51.1 with connection for chemistry module "C1" or "CF" is needed
Frequency converter RD51.2 with connection for chemistry module "CF" is needed
With NAMUR-terminal strip
Frequency converter RD51.1 with connection for chemistry module "C1" or "CF" is needed
Frequency converter RD51.2 with connection for chemistry module "CF" is needed
In the configuration for freqiency converter CFG-RD500 is to choose the expanded control termninal strip T1
② Rated current frequency converter "045" is only available with nominal connecting voltage "6"

TLZU0008EN00.FH9

Fig.: 3-1 Type key RZC02.1

Technical Data

Chemistry module		005	007	011	018	022	037	045
Nominal connecting voltage 3AC 400 V ±15 %								
Rated power	kW	4	5,5	7,5	15	18,5	30	37
Rated current	A	10	13	18	30	35	56	68
Max. Output frequency	Hz	200						
Nominal connecting voltage 3AC 500 V ±10 %								
Rated power kW		4	5,5	7,5	15	18,5	30	-
Rated current	A	8,0	10	14	24	28	45	-
Max. Output frequency	Hz	100						
Nominal connecting voltage 3AC 400 V ±15 % / 3AC 500 V ±10 %								
Size classes		A		B		C		
Pulse frequency	Hz	≥ 8						
Max. length Motor cables [1)]	m	400 (shielded cables 200)						
Ambient conditions								
Environmental class		3K3 according to DIN IEC 721-3-3						
ambient temperature - at bearing assembly - in operating		 -25 °C... 70 °C 0 °C ... 40° C						
noise suppression level		A1 according to EN 55011						
interference immunity		EN 50082-2						

1): At group drive, accumulated number of all connected motor cables are valid.

Tab.: 3-1 Technical Data

Type Label

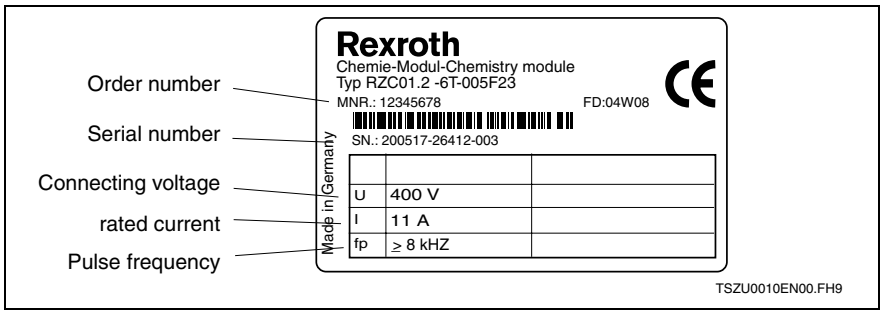


Fig.: 3-2 Type Label RZC01.2

Circuit principle

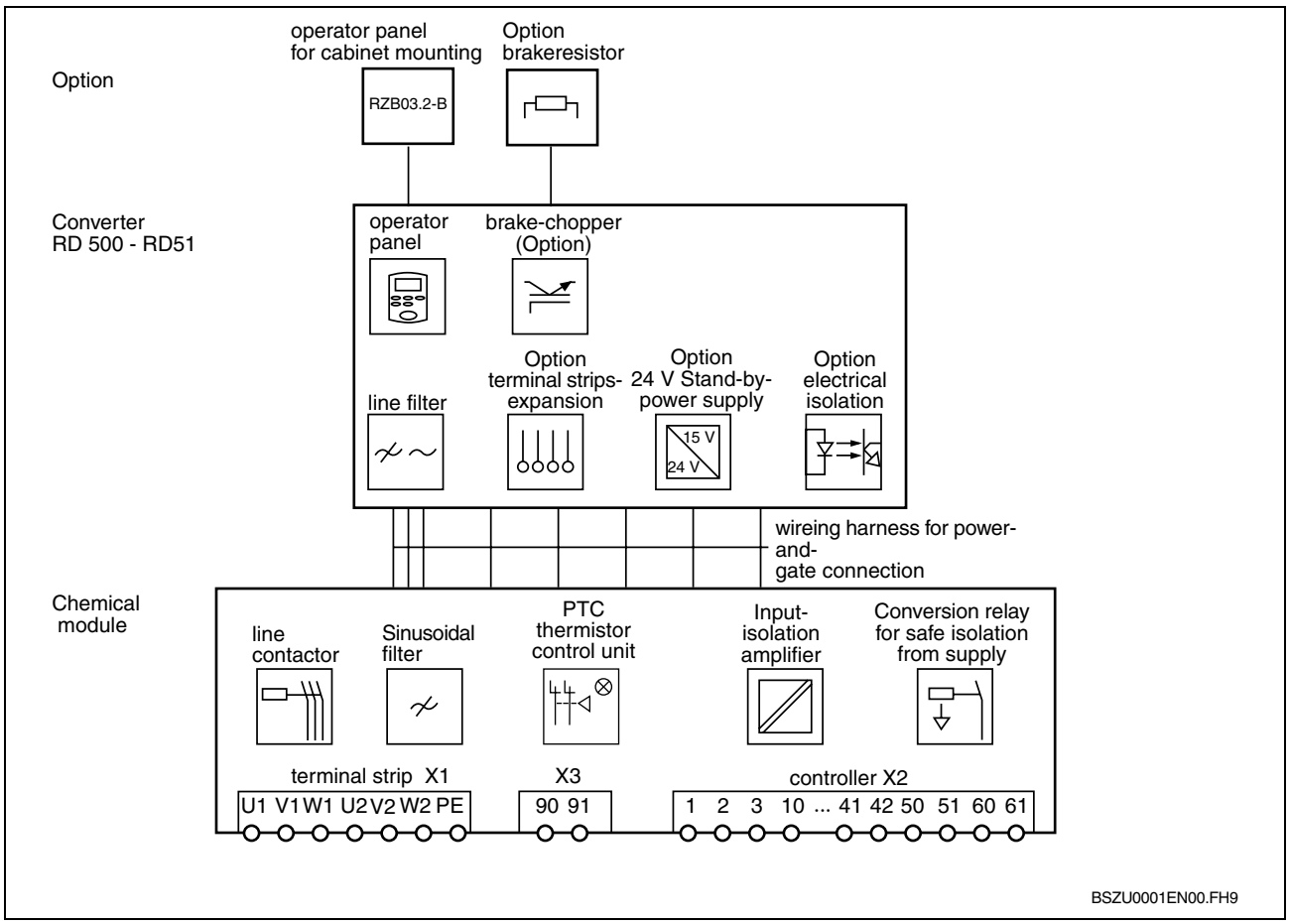


Fig.: 3-3 Circuit principle RZC01.2 design with Namur-terminal strip

3.2 Mechanical Assembly

Storage and Setup

Storage

The devices must be stored in a clean, dry space. The storage temperature must be between -25 °C and +70 °C.

Minimum Requirements at the Installation Location

- The operating area should be dust-free. Dust-laden air must be filtered
- The ambient temperature must lie between 0 and 40 °C.
- The relative humidity may not exceed 90 %; condensation is not permissible.
- The supplied air must not contain any aggressive or electrically conducting gases that may endanger functioning of the device.
- The airflow of the fans may not be impeded. The minimum free spaces specified for the supply air and exhaust air for each size class must not be restricted by additional add-ons.
- The device causes power loss and heats the surroundings. Therefore, a sufficient spacing from heat-sensitive devices must be ensured.

Assembly of Chemistry module

The Chemistry modules have the same height and width as the AC drive converters, sizes A to C. The Chemistry modules have a modular dimension of 22.5 mm. When using mounting rails with threaded holes in this grid pattern, several units can be mounted next to each other without having to maintain any intermediate space.

The following points must be observed when mounting:

- The units must be mounted vertically on a flat mounting surface.
- When the units are mounted in the cabinet, the cooling air requirement of the installed devices must be calculated and the cabinet cooling appropriately dimensioned.
- The metal enclosure of the Chemistry module must be connected through the largest possible surface area to the cabinet or the mounting panel so that a good electrical contact is established. If required, use contact- or serrated washers.
- The required mounting screws are specified in the drilling templates of the dimensioned drawings.

Dimension Drawing

An assembled Chemistry module, size classes A, B and C, is shown in the drawing.

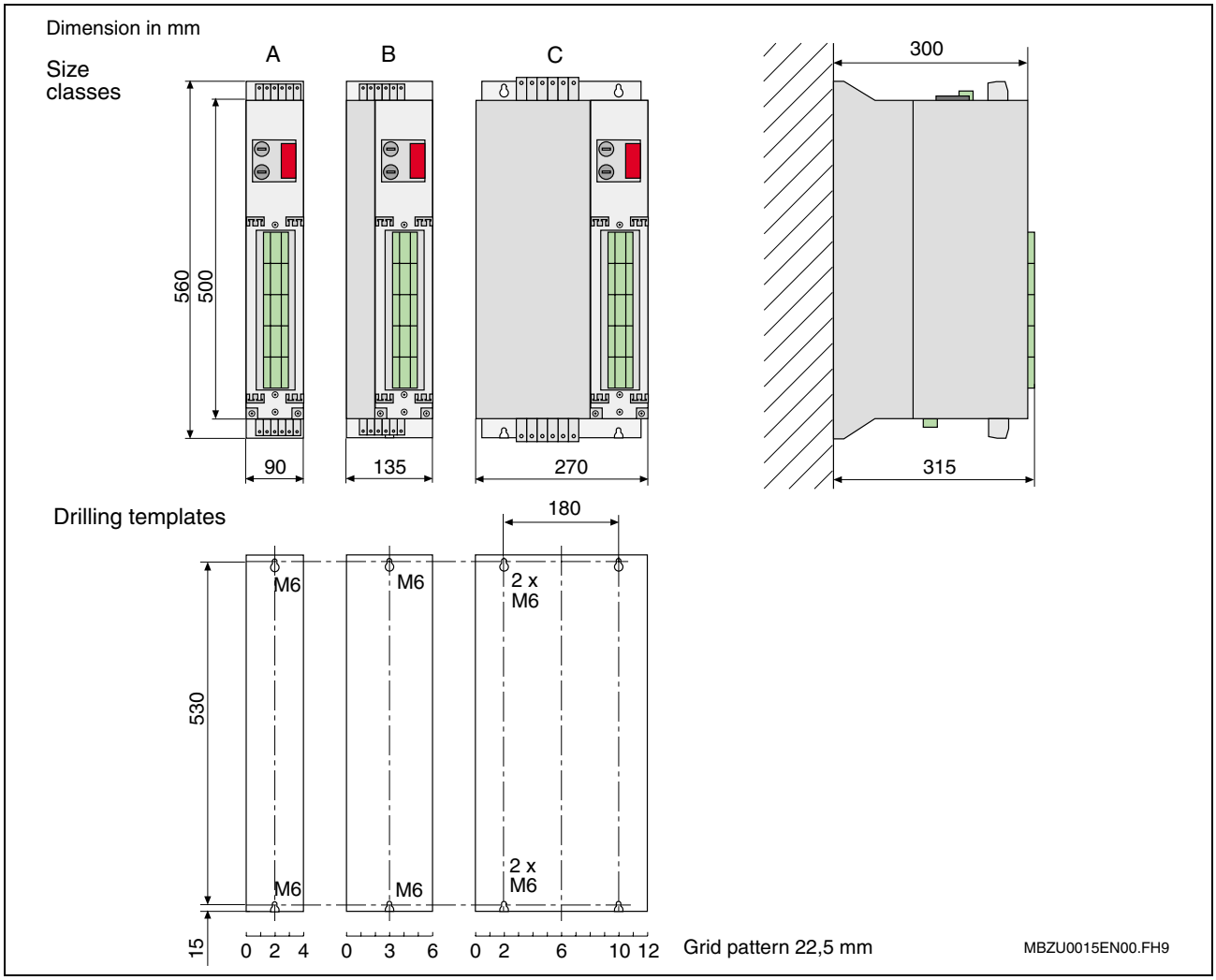


Fig.: 3-4: Dimension Drawing Chemistry module size classes A, B and C

Mounting example

The distance between converter and Chemistry module must be observed.

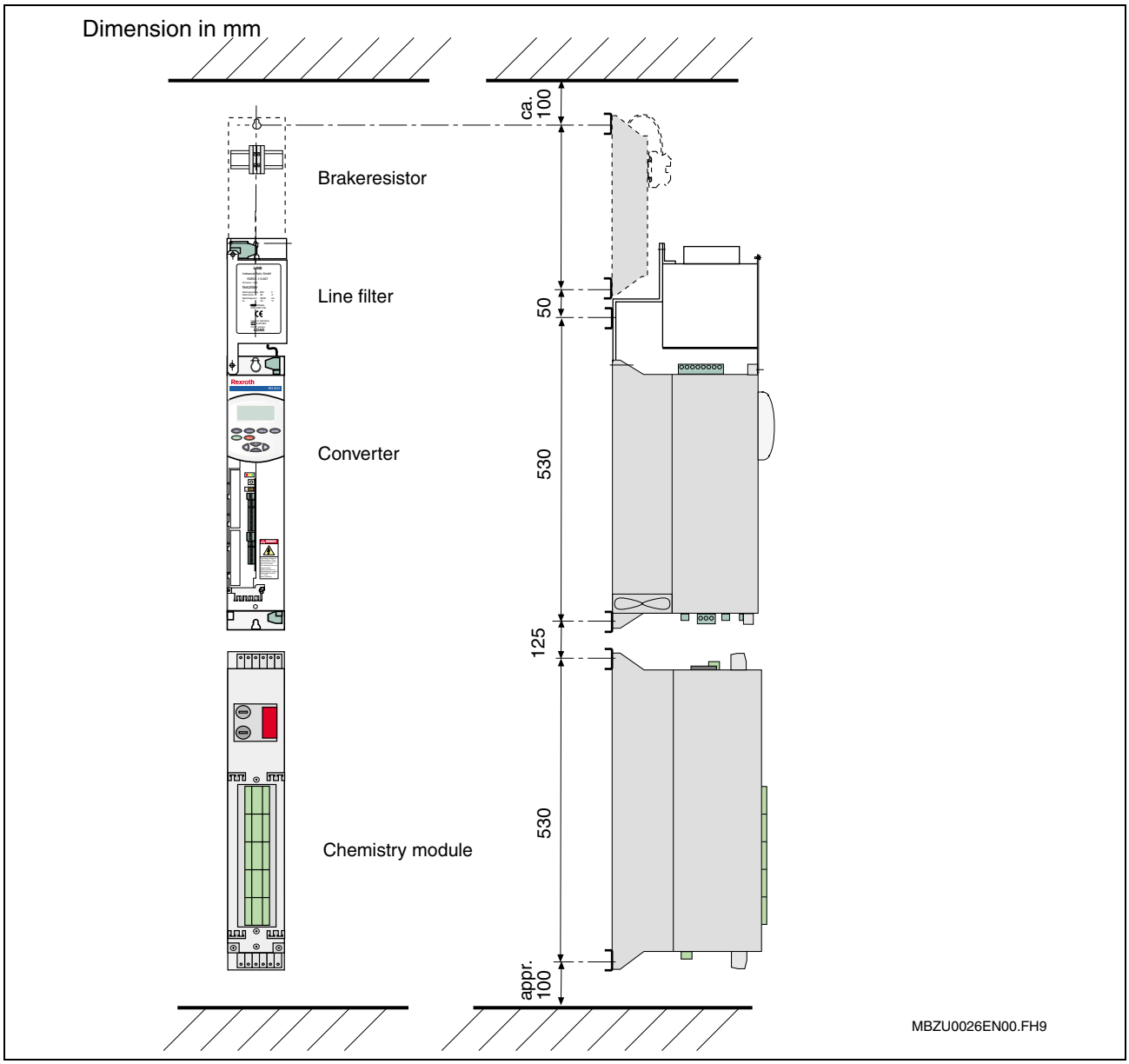


Fig.: 3-5 Mounting example converter / Chemistry module size classes A and B

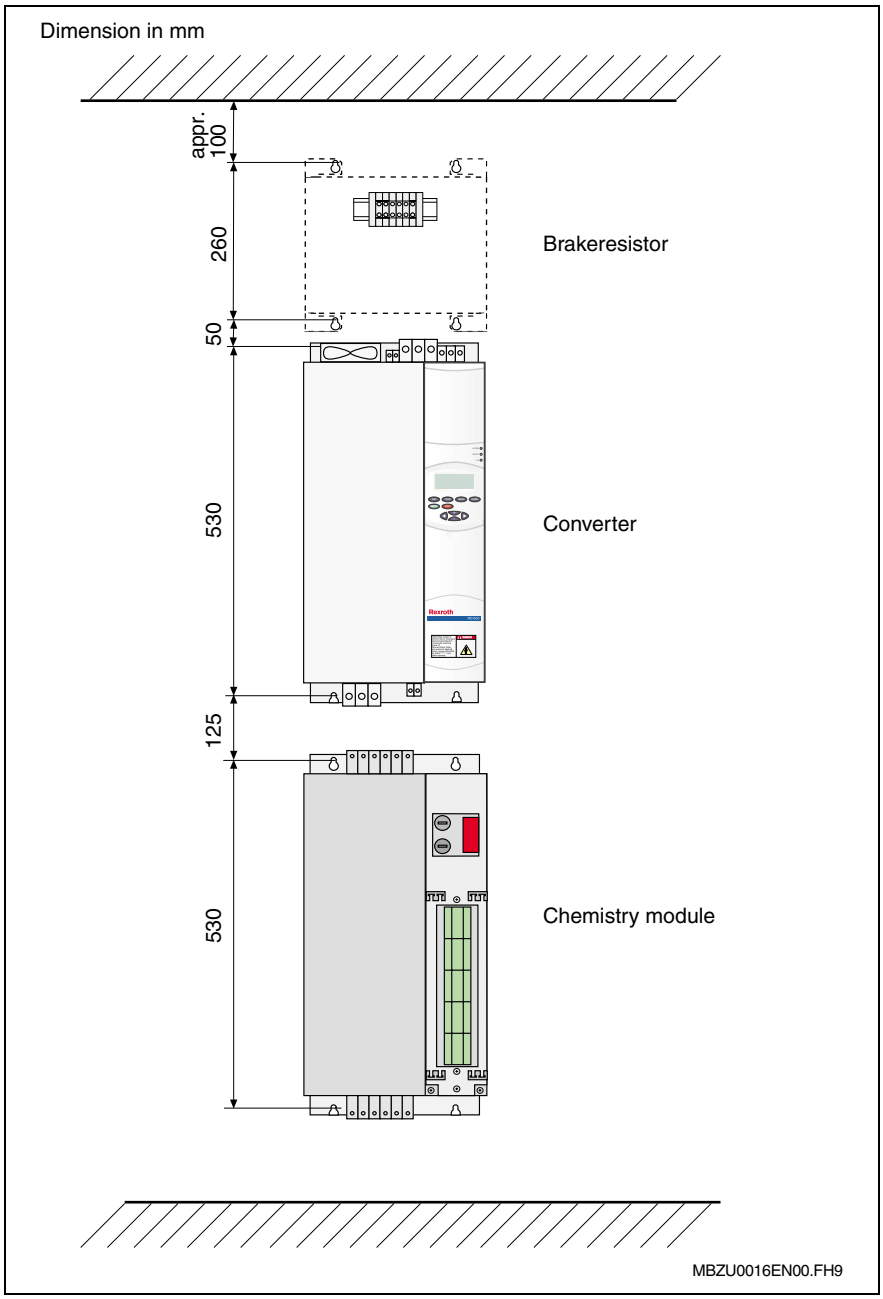


Fig.: 3-6 Mounting example converter / Chemistry module size class C

3.3 Electrical Installation

10 Rules for Installation of Drives According to EMC must be observed.

The metal enclosure of the Chemistry module must be connected flush with the cabinet or the mounting panel so that there is also a good electrical connection. If required, use contact- or serrated washers.

3.4 10 Rules for Installation of Drives According to EMC

The following 10 rules are the basics for designing drive systems in compliance with EMC.

Rules 1 to 7 are generally valid. Rules 8 to 10 are especially important to limit noise emission.

Rule 1 All metal parts of the switch cabinet should be connected with one another through the largest possible surface area so that the best electrical connection is established (no paint on paint!). If necessary, use contact or scraper discs. The cabinet door should be connected to the cabinet using the shortest possible grounding straps.

Rule 2 Signal, line supply, motor and power cables should be routed away from another (this eliminates mutual interference!). The minimum clearance is 20 cm. Barriers should be provided between power and signal cables. These barriers should be grounded at several locations.

Rule 3 Contactors, relays, solenoid valves, electromechanical operating hour counters etc. in the cabinet must be provided with noise suppression devices, e.g. using RC elements, diodes, varistors. These devices must be connected directly at the coil.

Rule 4 Non-shielded cables belonging to the same circuit (feeder and return cables) should be twisted with the smallest possible distance between them. Wires which are not used must be grounded at both ends.

Rule 5 Generally, noise which is coupled in can be reduced by routing cables as closely as possible to grounded steel panels. For this reason, cables and wires should not be routed freely in the cabinet, but as closely as possible to the cabinet itself and the mounting panels. This is also true for reserve cables.

Rule 6 Incremental encoders must be connected using shielded cables. The shield must be connected at the incremental encoder and at the AC drive converter through the largest possible surface area. The shield may not be interrupted, e.g. using intermediate terminals.

Rule 7 The shields of signal cables must be connected to ground at both ends through the largest possible surface area to establish a good electrical connection (transmitter and receiver). If the potential bonding between the screen connections is poor, an additional potential bonding conductor with a cross-section of at least 10 mm² (AWG 6) should be connected in parallel with the shield to reduce the shield current. The shields can be connected to ground at several locations, e.g. on the cabinet housing and on cable trays. Foil shields are not recommended. Braided screens provide a better shielding effect (factor of 5).

If the potential bonding is poor, analog signal cables may only be grounded to the converter at one end in order to prevent low-frequency noise being radiated into the screen (50 Hz).

Rule 8 Always place a radio interference suppression filter close to the noise source. The filter is to be connected flush with the cabinet housing, mounting plate, etc. The best solution is a bare metal mounting panel (e.g. stainless steel, galvanized steel), because the complete mounting surface can be used to establish good electrical contact.

The incoming and outgoing cables of the radio interference suppression filter should be separated.

Rule 9 All variable-speed motors should be connected using shielded cables, whereby the shield is connected at both ends to the housings through the largest possible surface area to minimize the inductance. The motor feeder cables should also be shielded outside the cabinet, or at least screened using barriers.

Cables with steel shields are not suitable.

To connect the shield at the motor, a suitable PG gland with shield connection can be used (e.g. “SKINDICHT SHV/SRE/E” from the Lapp Company, Stuttgart). It should be ensured that the connection between the motor terminal box and the motor housing has a low impedance. Otherwise, use an additional grounding strap between them. **Never use plastic motor terminal boxes!**

Rule 10 The shield between the motor and the frequency converter may not be interrupted by installing components such as output reactors, sinusoidal filters, motor filters, fuses, contactors, etc. The components must be mounted on mounting panels which also simultaneously serve as the shield connection for the incoming and outgoing motor cables. Metal barriers may be required to shield the components.

3.5 Warnings and Notes

DANGER

Death by electrocution possible due to live parts with more than 50 V!

⇒ RD 500 devices are operated at high voltage levels. All work must be carried out when they are not under power!

⇒ All work must be carried out only by qualified personnel!

⇒ If this warning information is not observed, death, severe bodily injury or significant material damage can result.

⇒ Due to the DC link capacitors, the device is still under a dangerous voltage up to 30 minutes after power has been switched off. This means that it is only permissible to work on the device or the DC link terminals after an appropriate time and after a careful check has been made to ensure that the equipment really is not under power.

⇒ The power and control terminals may be live even if the motor is at a standstill.

⇒ In the case of a central supply of the DC link voltage, ensure that the inverter is safely separated from the DC link voltage!

⇒ When working on an open device, note that live parts are exposed.

⇒ The user is responsible for ensuring that all devices are set up and connected according to the recognized technical regulations in the country of use as well as other regionally valid regulations. Cable dimensioning, fuse protection, grounding, switching off, separation and protection from excess currents must be especially taken into account.

Power terminals

Terminal Layout diagram Chemistry module with NAMUR-terminal strip

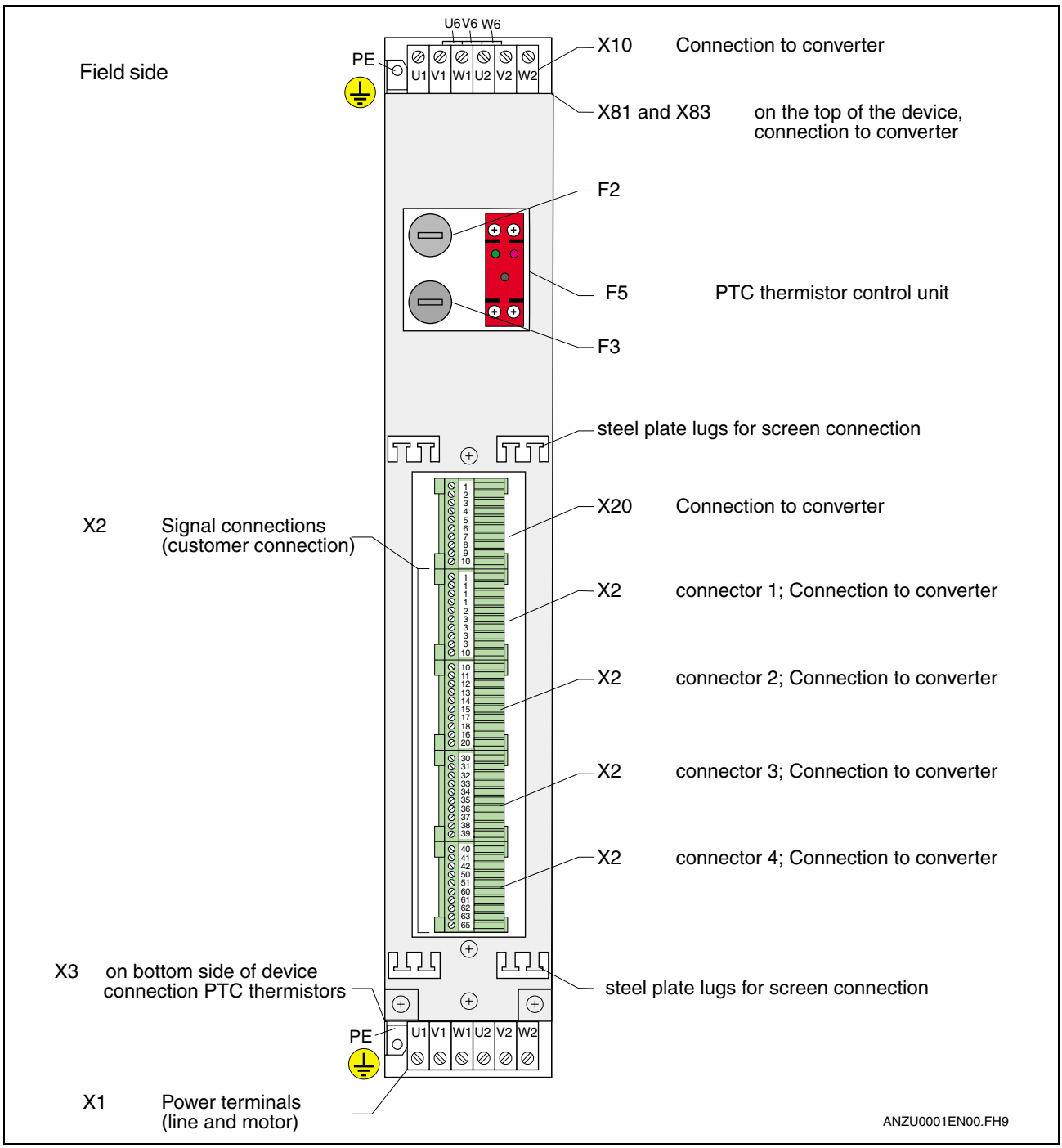


Fig.: 3-7 Terminal Layout diagram Chemistry module with NAMUR-terminal strip

Terminal Layout diagram Chemistry module without NAMUR-terminal strip for field bus connection

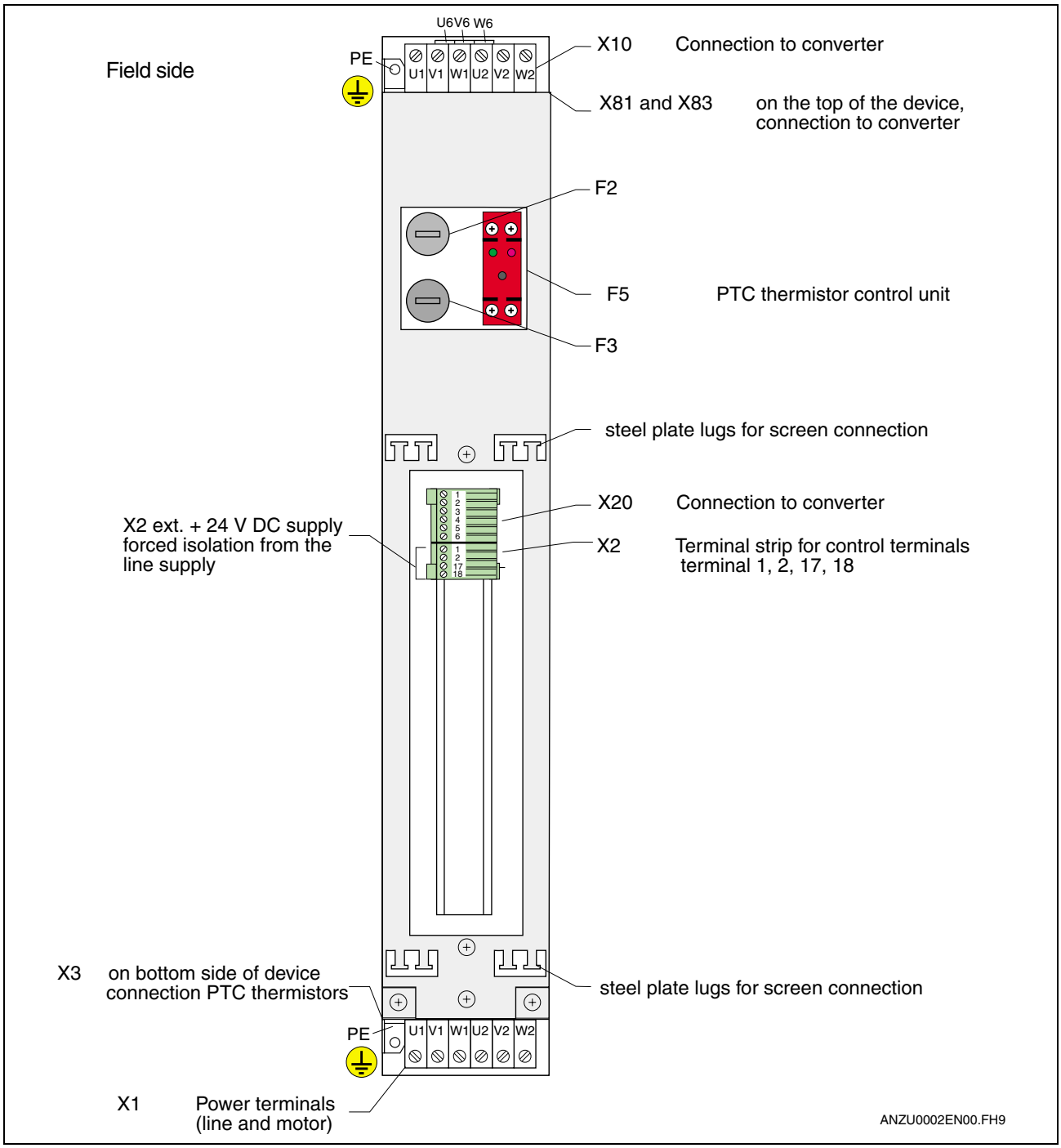


Fig.: 3-8 Terminal Layout diagram Chemistry module without NAMUR-terminal

Cable Cross-Sections

The cable cross-sections refer to the rated converter current. The associated protective conductor cross-section must be a minimum of 10 mm^2 (AWG 6) (if power cables with cable cross-sections >10 mm^2 (AWG 6) are used, the protective conductor must have the same cross-section).

The following is assumed for the line supply feeder cables / DC link cables:

- The cross-sections are valid for one phase for multi-stranded conductors, and were defined in accordance with VDE0298.
- Up to 35 mm^2 (AWG 2), individual wires in a cable duct.
- Above 50 mm^2 (AWG 1/0), freely routed in the cabinet without any contact to other cables

The following is assumed for motor feeder cables:

- The cross-sections are valid for shielded 4-core cables and were defined in accordance with VDE0298.
- Up to 35 mm^2 (AWG 2), routed in the cable duct, without any cable bundling.
- Above 50 mm^2 (AWG 1/0), freely routed in the cabinet without any contact to other cables.

Description of Converter Power Terminals

X1, Power supply connection, Motor connection

Execution

RZC01.2-xx-	Type	number	Execution
005 / 007 / 011 / 018 / 022 / 037 / 045	High current bushing terminal	6	Screw terminal

Tab.: 3-9: Execution

Identification single connection

Identification	signification	
U1	Phase L1	for permissible line supply voltage, refer to the rating plate on the upper side of the drive unit
V1	Phase L2	
W1	Phase L3	
U2	Motor connection	
V2	Motor connection	
W2	Motor connection	

Tab.: 3-10: Identification single connection

Protective conductor connection

- Cross section (PE) min 10 mm² (AWG 6)
- steel plate lug on the housing with captive nut...
  - ... M5 at size classes A and B (torque 2.5 – 3.0 Nm)
  - ... M6 at size class C (torque 4.2 – 5.0 Nm)

connection cross section at nominal connecting voltage 3 AC 400 V ±15 %

RZC01.2-6x-	Cable cross-section which can be connected 1) in mm	AWG	torque
005	0.5 - 10	20 – 8	1.5 – 1.8
007	0.5 - 10	20 – 8	1.5 – 1.8
011	0.5 - 16	20 – 6	2.0 – 2.3
018	0.5 - 16	20 – 6	2.0 – 2.3
022	16 - 50	6 – 1/0	6 - 8
037	16 - 50	6 – 1/0	6 - 8
045	16 - 50	6 – 1/0	6 - 8

1): A result of the terminal size

Tab.: 3-11: connection cross section at nominal connecting voltage 3 AC 400 V ±15 %

connection cross section at nominal connecting voltage 3 AC 500 V ±15 %

RZC01.2-5x-	Cable cross-section which can be connected 1) in mm	AWG	torque
005	0.5 - 10	20 – 8	1.5 – 1.8
007	0.5 - 10	20 – 8	1.5 – 1.8
011	0.5 - 16	20 – 6	2.0 – 2.3
018	0.5 - 16	20 – 6	2.0 – 2.3
022	16 - 50	6 – 1/0	6 - 8
037	16 - 50	6 – 1/0	6 - 8

1): A result of the terminal size

Tab.: 3-12: connection cross section at nominal connecting voltage 3 AC 500 V ±15 %

torque See table

Fuses

RZC01.2-x-	Max. back-up fuse type gL in A	
	nominal connecting voltage 3 AC 400 V ±15 %	nominal connecting voltage 3 AC 500 V ±15 %
005	10	10
007	16	16
011	20	16
018	35	35
022	50	35
037	63	50
045	80	-

Tab.: 3-13: Fuses

X2, General terminals

Execution

RZC01.2-xx-	Type	number	Execution
005 / 007 / 011 / 018 / 022 / 037 / 045	plug	4	Plug-in connection

Tab.: 3-14: Execution

Identification single connection

Terminal	Note	
X2	**General terminals**	
1	ground 24 V	Reference cable for +24 V DC, if grounded, this is externally realized
2	+24 V DC	+24 V DC incoming supply
3		DC 24 V –15 / +24 %, ripple, max 5 % (VDE0411 / 500), power consumption 60 W, startup current 5 A
4	Internal	
5		
6		
X2	**Digital inputs**	
10	On (dynamic)	The AC drive converter is powered-up with "1", i.e. the power electronics is connected to the line supply voltage and the data processing electronics start the inverter. The unit is powered-up using an edge evaluation circuit. The signal is only effective in the NORMAL setting.
10	On / Off (static)	The drive converter is powered-up with a "1" and remains powered-up until the signal goes to "0". The signal is only effective in the NORMAL setting.
11	Off (dynamic)	The command to power-down the unit (the continuous "1" signal goes to "0"). The signal is only effective in the "NORMAL" setting..
12	Faster	"1" signal increases the motor speed. The signal is only effective in the NORMAL setting.
13	Slower	"1" signal reduces the motor speed. The signal is only effective in the NORMAL setting.
14	Reset	Resets a group fault or an individual fault with a "1" signal. The signal is only effective in the NORMAL setting.
15	Interlocking (external fault)	The command to power-down the unit (the continuous "1" signal goes to "0"). The signal is only effective in the "NORMAL" setting.
16	Counter-clockwise rotation	Selects the output rotating field: "0“ signal = clockwise rotating field "1“ signal = counter-clockwise rotating field The signal is only effective in the "NORMAL" setting
17	Forced isolation from the line supply	This is used to directly power-down the drive (the continuously available "1" signal goes to "0"); this acts automatically on the power switching device. This is effective in the TEST and NORMAL setting. The data processing electronics is still supplied so that the signals and displays are still available.
18		
20	Internal	
X2	**Digital outputs**	
30	Ready-to-power-up	"1" signals that the drive is ready to run, i.e. the data processing electronics is functioning.
31		
32	Motor rotating	"1" signal signals a rotating motor. A starting bypass must be provided due to the preparation time of the drive converter.
33		

Terminal	Note	
34	Fault	"1" and "0" signal. The fault signal from the PTC thermistor tripping device is processed in the signal.
35		
36		
37	Digital output (option)	"1" and "0" signal which can be freely assigned by appropriately parameterizing the drive converter. This must be set using P0888, optional relay 3 in basis parameterization. A selection can be made from 23 signals.
38		
39		
40	Digital output (option)	"1" and "0" signal which can be freely assigned by appropriately parameterizing the drive converter. This must be set using P0889, optional relay 3 in basis parameterization. A selection can be made from 23 signals.
41		
42		
X2	**Analog input**	
50	Speed setpoint	It is selected whether the analog input is assigned the speed setpoint or the digital inputs "faster" and "slower" using the drive converter parameterization.
51		
X2	**Analog outputs**	
60	Motor frequency	Analog output signal
61		Analog output GND
62	Motor current	Analog output signal
63		Analog output GND
64, 65		The analog outputs are not assigned!

Tab.: 3-15: Identification single connection

X3, PTC thermistor

Execution

RZC01.2-xx-	Type	Pole number	Execution
005 / 007 / 011 / 018 / 022 / 037 / 045	plug	2	Plug on device

Tab.: 3-16: Execution

Identification single connection

X3	PTC thermistor	
90	Temperature sensor	Connection for the PTC thermistor sensor in the motor. This input can also be used as digital input ("1" signal goes to "0") of another external motor protection device.
91		

Tab.: 3-17: Execution

Connection cross section

RZC01.2-xx-	Cable cross-section which can be connected [1)] in mm	AWG
005 / 007 / 011 / 018 / 022 / 037 / 045	0.2 – 2.5	24 - 14

1): A result of the terminal size

Tab.: 3-18: Connection cross section

torque

0.22 – 0.25 Nm

Connecting terminal units to converter

For connection between Chemistry module with converter, all required prefabricated wiring cables are part of delivery.

X10, Connection to converter

Execution

RZC01.2-xx-	Type	number	Execution
005 / 007 / 011 / 018 / 022 / 037 / 045	High current bushing terminal	6	Screw terminal

Tab.: 3-19: Execution

Identification single connection

Identification	signification
U1	Connection to converter at plug connector X1: U1, V1, W1
V1	
W1	
U2	Connection to converter at plug connector X2: U2, V2, W2
V2	
W2	

Tab.: 3-20: Identification single connection

Protective conductor connection

- Cross section (PE) min 10 mm² (AWG 6)
- steel plate lug on the housing with captive nut...
  - ... M5 at size classes A and B (torque 2,5 – 3,0 Nm)
  - ... M6 at size class C (torque 4.2 – 5.0 Nm)

connecting cross section

RZC01.2-6x-	Cable cross-section which can be connected 1) in mm	AWG	torque
005	0.5 - 16	20 – 6	1.5 – 1.8
007	0.5 - 16	20 – 6	1.5 – 1.8
011	0.5 - 16	20 – 6	1.5 – 1.8
018	0.5 - 16	20 – 6	1.5 – 1.8
022	0.5 - 16	20 – 6	1.5 – 1.8
037	16 - 50	6 – 1/0	6 - 8
045	16 - 50	6 – 1/0	6 - 8

1): A result of the terminal size

Tab.: 3-21: Connection cross section

torque See table

X10, Filter current feedback

Execution

RZC01.2-xx-	Type	Pole number	Execution
005 / 007	plug	3	Plug on device
011 / 018 / 022 / 037 / 045	Bushing terminal	3	Screw terminal

Tab.:22: Execution

Identification single connection

Identification	signification
U6	Operation possible only with the original filter
V6	
W6	

Tab.:23: Identification single connection

connecting cross section

RZC01.2-xx-	Cable cross-section which can be connected [1] in mm	AWG	torque
005 / 007	0.2 – 4	24 – 10	0.5– 0.6 Nm
011 / 018 / 022 / 037 / 045	0.2 – 4	24 – 10	0.5– 0.8 Nm

1): A result of the terminal size

Tab.: 3-24: connecting cross section

Note: Converter without additional function F1, the terminals U6, V6 and W6 must be bridge connected.

At delivery the terminals are insert with bridges.

X20, Diverse functions

Connection to converter on different terminals, accordingly the terminal markings.

X81 Contactor selection

Internal Connection to converter terminal X81

X83 P24 V Stand-by-power supply for converter-electronics information

Connection to converter terminal X83

Execution

RZC01.2-xx-	Type	Pole number	Execution
005 / 007 / 011 / 018 / 022 / 037 / 045	Plug	2	Plug on device

Tab.: 3-25: Execution

Identification single connection

Identification	signification
1 (+)	P24 V 24 V DC –15 / +20 %, ripple max. 5 % (VDE0411 / 500), power consumption ~40 W
2 (-)	ground

Tab.: 3-26: Identification single connection

connecting cross section

RZC01.2-xx-	Cable cross-section which can be connected [1] in mm	AWG
005 / 007 / 011 / 018 / 022 / 037 / 045	0.2 – 2.5	24 - 14

1): A result of the terminal size

Tab.: 3-27: connecting cross section

torque 0.22 – 0.25 Nm.

Circuit Principle Chemistry module

...without NAMUR-terminal strip e. g. for field bus connection

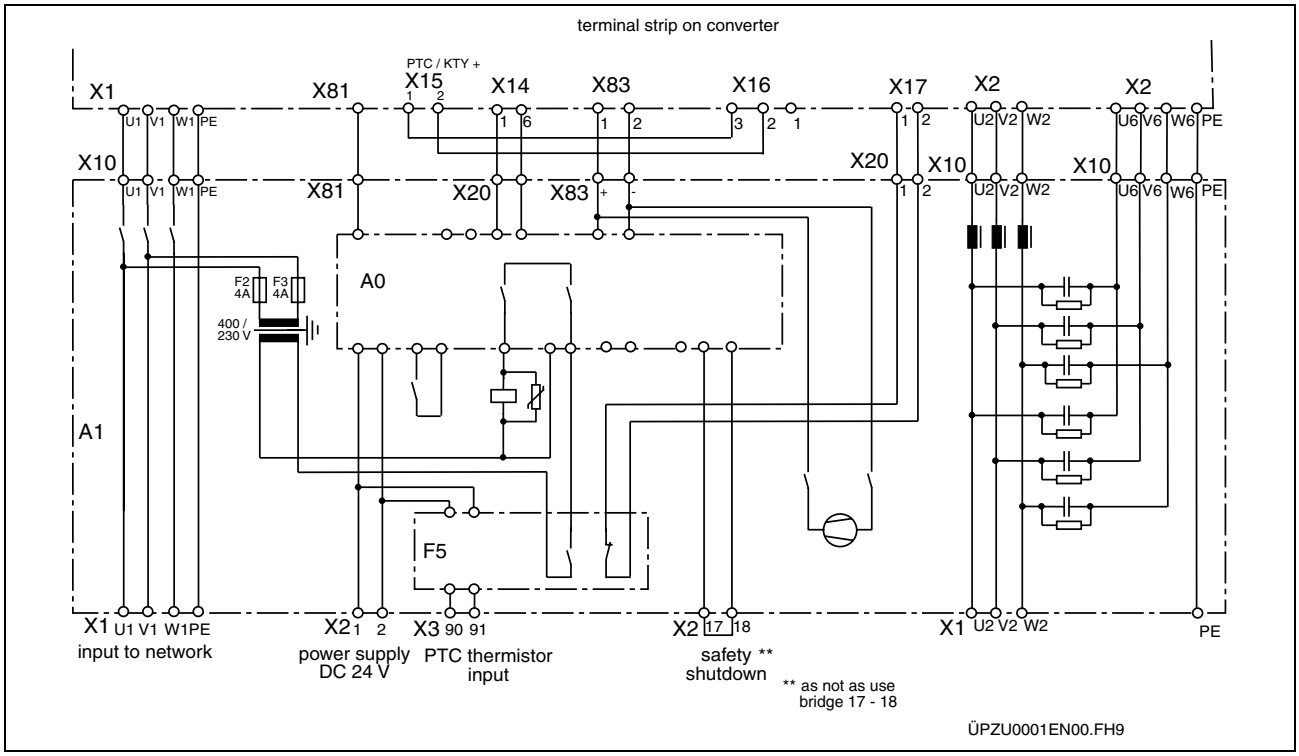


Fig.: 3-28 Circuit Principle Chemistry module without NAMUR-terminal strip

...with Namur-terminal strip

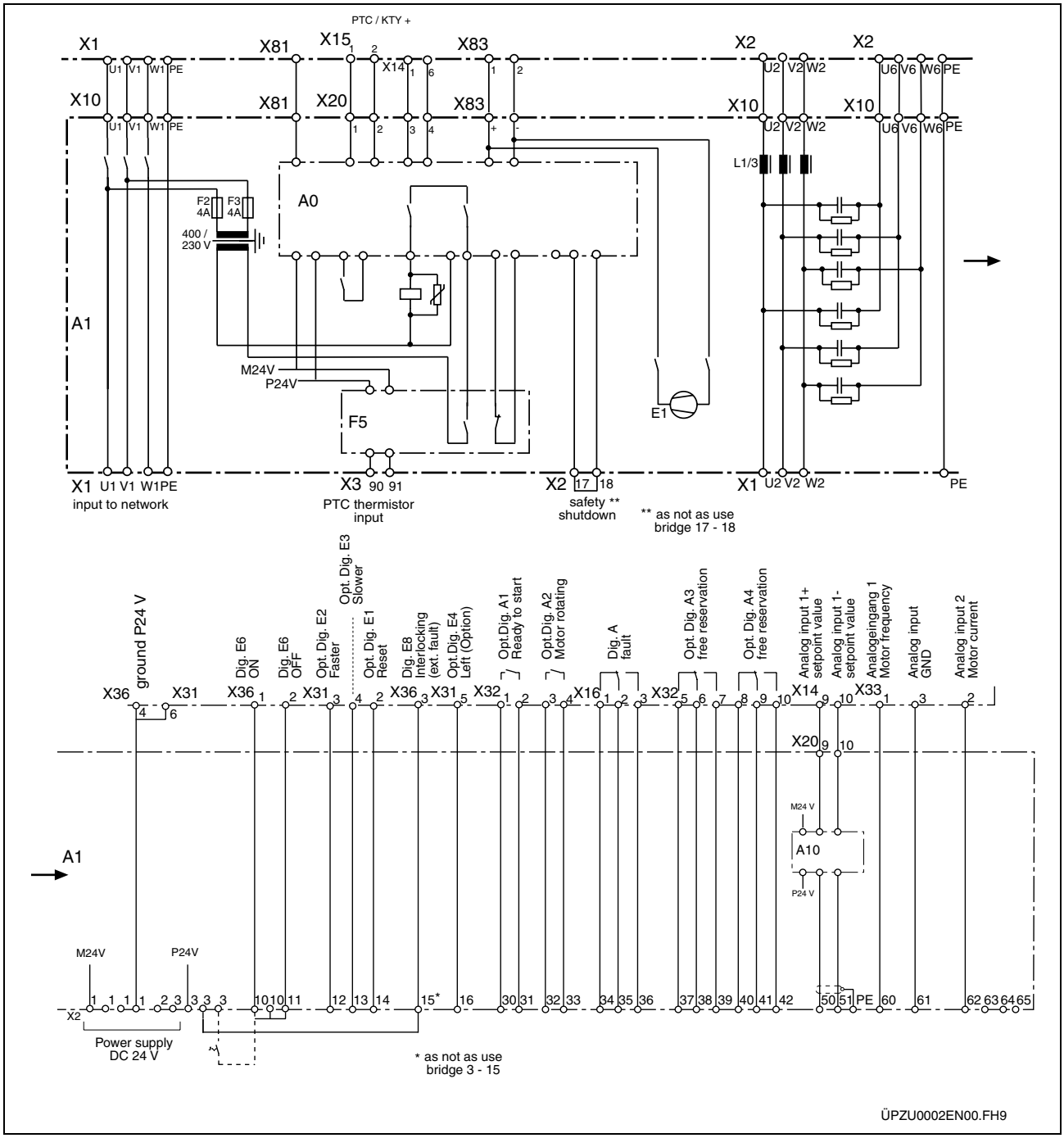


Fig.: 3-29 Circuit Principle Chemistry module with NAMUR-terminal strip

3.6 Operating

Caution

The Chemistry modules may only be operated at pulse frequencies ≥8 kHz as a result of the integrated sinusoidal filter.

CAUTION

Damage to property due to components overload!

⇒ Pulse frequencies smaller 8 kHz can be destroy ruin the sinusoidal in Chemistry modules!

If the drive converter is ordered as RD 500 devices or for applications in the chemical and process industries, the appropriate firmware is already downloaded into the drive converter and the NAMUR functions have been enabled. In this case, the pulse frequency is set to 8 kHz.

Output frequency

For 400 V Chemistry modules, the maximum drive converter output frequency is 200 Hz.

For 500 V Chemistry modules, the maximum drive converter output frequency is 100 Hz.

NAMUR standard values in converter

In connection with RZC-Modules – version NAMUR, the NAMUR functions must be activate on the RD 500 devices.

The following proceeding is necessary:

P0071 3 = load factory setting for NAMUR applications basic

Saving Dates in Eeprom

At delivered cabinet mounting with RZC-Modules – design NAMUR, the necessary setting values on converter are take before. The following standard values are set, deviating from the basis parameterization:

Parameter No. / Index	Parameter text	value at NAMUR - functions
P0026	Pulse frequency	80 = 8.0 kHz
P0057	NAMUR functions	1 = active
P0064	Parameteriz. level	0 = basic parametrizat.
P0099	max. o/p frequency	11000
P0385	Select KTY/PTC X15	2 = PTC
P0388	PTC Evaluation X15	1 = switch off
P0491.5	Source SI4 PZD	1121
P0564.0	Reaction on. I < 4mA	1 = alarm
P0564.1	Reaction on. I < 4mA	0 = no action
P0730	Fixvvalue for D1517	500 = 5.00 %
P0731.1	Fixvv. for D1518, D1519	500 = 5.00 %
P0743.0	output block	1 = +20 % ... +100 %
P0743.1	output block	1 = +20 % ... +100 %
P0756	time1 timer	20 = 2.0 sec
P0757	Hysteresis x:xs	250 = 2.5 %
P0759	Hysteresis x:xs	250 = 2.5 %
P0870	On / Off in NORMAL	6 = term dyn. (OFFalways)
P0871	On / Off in TEST	7 = panel dyn. (OFFalways)
P0872	Setpoint in NORMAL	12 = analog input 2 ... +10 V
P0878	digital input4	0 = I no function
P0879	digital input5	7 = I not volt.disc
P0880	digital input8	3 = I not fault. ext.
P0881	function relay	76 = O not fault
P0882	Opt. digital input1	34 = IN fault reset
P0883	Opt. digital input2	41 = IN Motp. faster
P0884	Opt. digital input3	42 = IN Motp. slower
P0885	Opt. digital input4	36 = IN direct.rotat.
P0886	Option relay 1	72 = O ready t switch on
P0887	Option relay 2	79 = O motor rotating 1
P0891	Opt.analogue outp.1	1 = Fact outp.frequenc
P0892	Opt.analogue outp.2	2 = lact outp.current

Tab.: 3-30: Standard values, deviating from the basis parameterization

4 RZF02.1Radio Interference Filter

4.1 Description of the Radio Interference Filter

Frequency converters of the RD 500 series have an integrated radio interference filter for connection to the industrial network according to EN61800-3 “EMC Product Standard for Variable-Speed Drives in the Second Environment” (industrial).

The RZF radio interference filter is used for additional reduction of the noise level to the permitted limit values for use in residential areas. Thus, the limit values of the “first environment” are maintained.

The limit values of standard EN61800-3 “First environment” correspond to the limit values of standard EN55011 class B.

The following line filters for radio interference are used for Bosch Rexroth. These are designed and measured especially for Bosch Rexroth drive systems. If other filter products are used, Bosch Rexroth cannot guarantee radio interference to permitted limit values.

Type Key

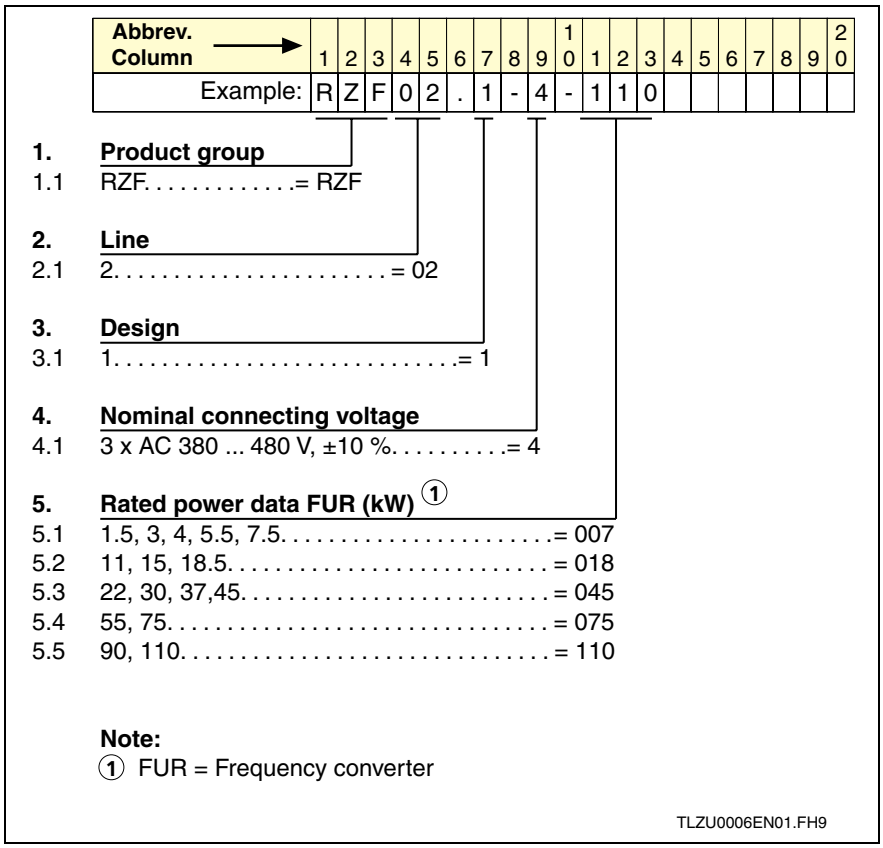


Fig.: 4-1 Type key radio interference filters

Technical Data

Radio Interference Filters for 400 V ... 480 V Connection Voltage:

Converter						Radio interference filter RZF02.1-4-...
Power class	Power code	Nominal current at 4 kHz switching frequency, A	Nominal current at 10 kHz switching frequency, A	Nominal current at 12 kHz switching frequency, A	Connection terminals, mm^2	Designation
1,5 / 3 / 4 / 5.5 / 7.5	007	20	13	11	10	RZF02.1-4-007
11 / 15 / 18.5	018	39	29	24	10	RZF02.1-4-018
37 / 45	045	90	66	57	50	RZF02.1-4-045
75	075	149	98,5	88	50	RZF02.1-4-075
110	110	215	119	88	150	RZF02.1-4-110

Tab.: 4-1 Technical data for radio interference filters

Note: Derating via switching frequency as for frequency converter

Connection Requirements

Connectable line lengths

Pulse frequency fp	Max. line length
12 kHz	35 m
10 kHz	50 m
4 kHz	80 m

Tab.: 4-2 Connection requirements for radio interference filters

Note: Shielded motor lines are to be used to maintain the limit value.

Ambient Conditions

Ambient conditions, noise suppression level, interference immunity	
Environmental class	3K3 according to DIN IEC 721-3-3 (Ambient temperature: 0 ... 40 °C)
Noise suppression level	EN 61800-3, first environment
Degree of protection	IP 20 according to EN 60529 (without connection terminals)

Tab. 4-3 Ambient conditions for radio interference filters

Note: EN61800-3 is “EMC Product Standard for Variable-Speed Drives” for the first environment, which includes residential areas as well facilities which are connected directly to a low-voltage network without an interstage transformer and which supply buildings in residential areas.

Setup Elevations Exceeding 1000 Meters above Sea Level:

At setup elevations exceeding 1000 meters above sea level, the utilization of the converter, the inverter and / or accessories are to be reduced according to the diagram below.

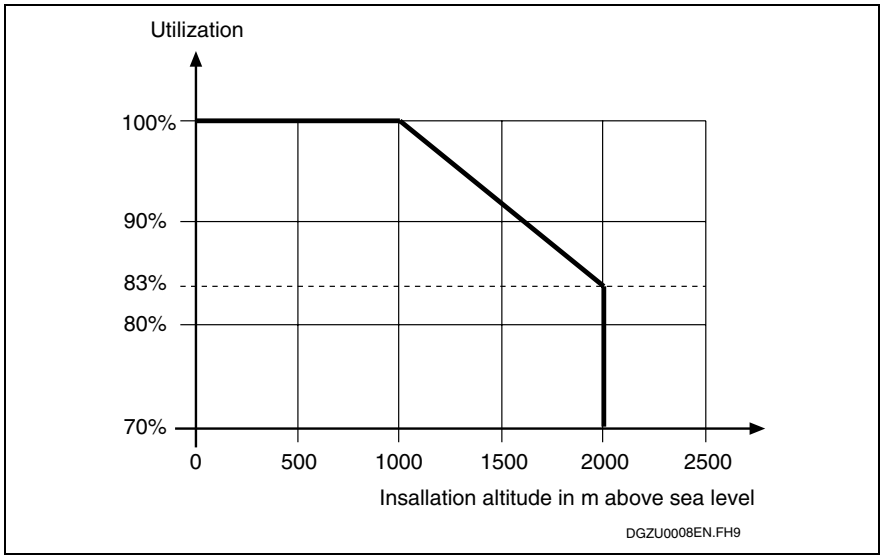


Fig.: 4-2 Derating depending on setup elevation

Type Label

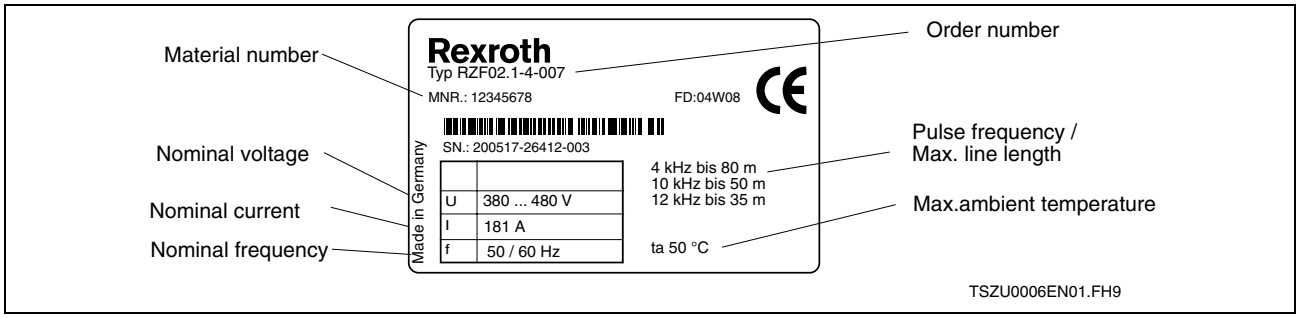


Fig.: 4-3 Type label for radio interference filters

4.2 Mechanical Assembly

Dimension Drawing

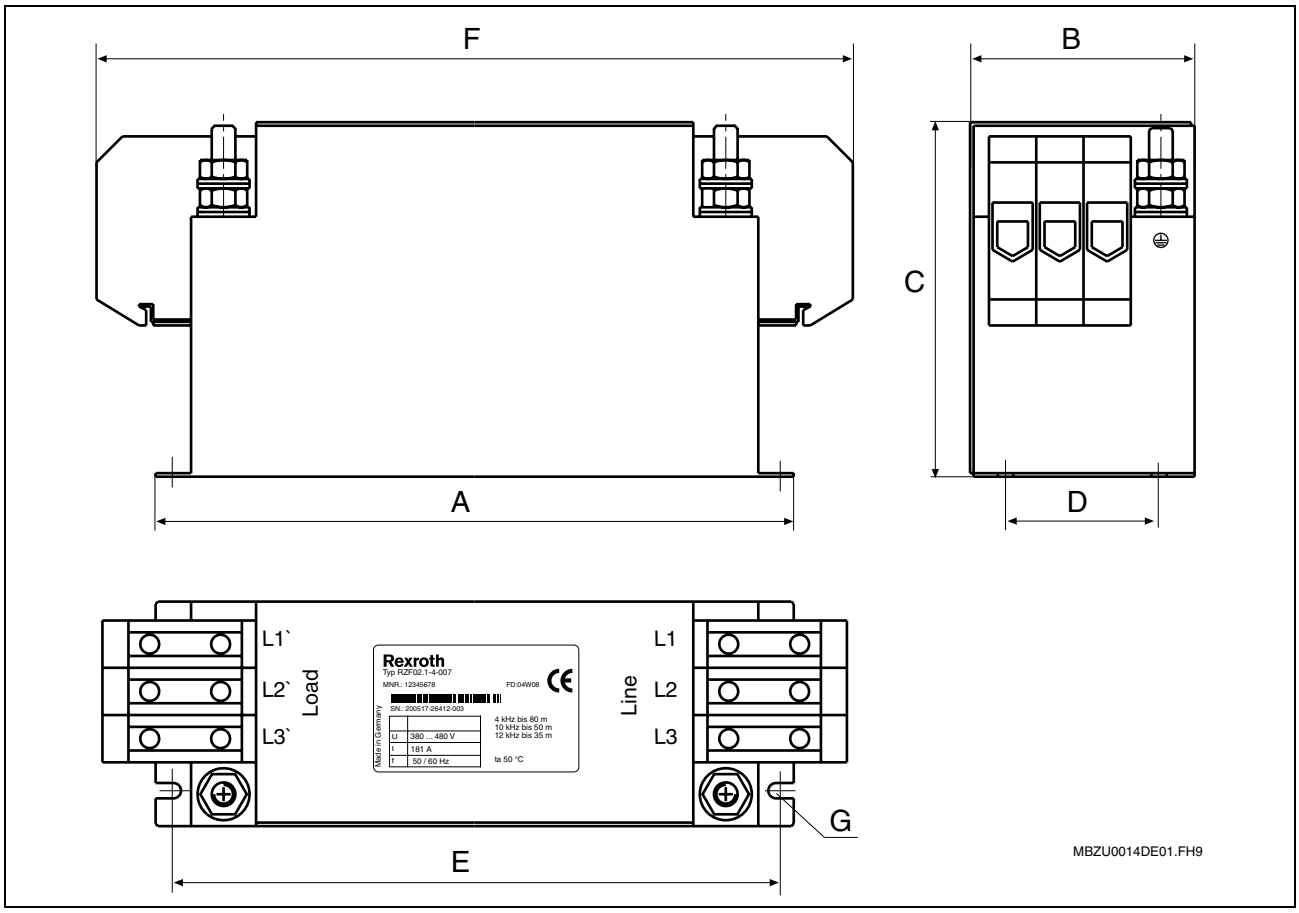


Fig.: 4-4 Dimension drawing for radio interference filters

Type	Dimensions, mm							Weight, kg
	A	B	C	D	E	F	G	
RZF02.1-4-007	270	55	90	30	255	240	5,5	1.7
RZF02.1-4-018	310	55	90	30	295	280	5,5	2.1
RZF02.1-4-045	270	95	150	65	255	320	6,5	4.8
RZF02.1-4-075	270	95	150	65	255	320	6,5	5.6
RZF02.1-4-110	380	130	181	102	365	450	6,5	12.2

Tab.: 4-4 Dimension drawing for radio interference filters

Assembly Example

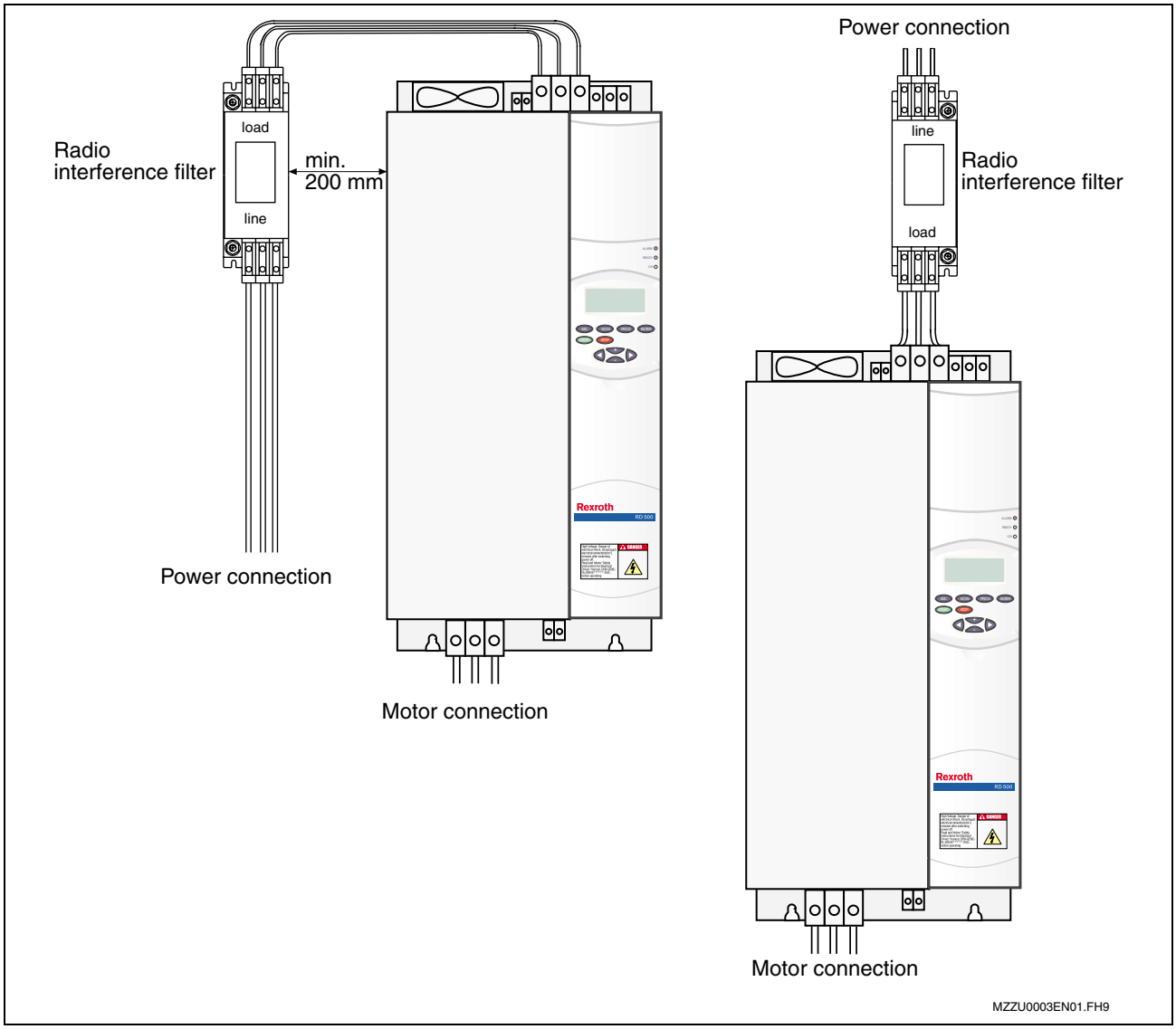


Fig.: 4-5 Assembly example for radio interference filters

Assembly

The filters can be arranged next to or above the converter. The filter is attached to the base with four screws. Galvanized or tinned screws are to be used (do not use coated or anodized connection elements and screws).

In addition, proceed as follows in the case of coated assembly plates:

- Selectively remove the coating at the connection points on the assembly surface in such a manner that safe and extensive contacting is possible.

The filter function of the line filter is ensured only if there is good grounding.

Note: Installation in the switch cabinet is to be executed according to generally valid construction recommendations for proper EMC installation; see the documentation DOK-GENERAL-EMV*REFU***-PR01-EN-P.

4.3 Connection

L1, L2, L3: Line: input of line filter

L1‘, L2‘, L3‘: Load: output of line filter

The lines are connected to the terminals on the line and load sides according to the labels.

For safety reasons, the grounding conductor between the line and the filter must

- have a minimum **cross-section of 10 mm²** (AWG 6) or be supplemented by a second grounding conductor via separate terminals (according to EN50178 / 1997, Section 5.3.2.1). If the outer conductor has a higher cross-section, the cross-section of the grounding conductor must be increased correspondingly.
- be **firmly connected**. It must be able to be loosened only with tools.

The reason is the high leakage currents of the radio interference filter in the grounding conductor that can result in the case of unbalanced loads in the three-phase system or in the case of phase failure. Therefore, line filters absolutely must be grounded before they are switched on for the first time. Suitable connection possibilities must be provided in the machine, in the system and in the switch cabinet.

4.4 Commissioning the Filter

Before the mains voltage is switched on or installed, the entire permanently installed ground conductor connection must be visually checked. Especially ensure that the exposed line ends are well-seated in the terminals and that the screws are tight.

In case of doubt, check whether the resistance between the main ground conductor of the power supply and the filter housing is lower than 0.1 Ohm.

Switch on the power supply only after this check is completed.

5 RZK0x.1 External Heat Exchanger

5.1 Description of the Heat Exchanger

An external heat exchanger is required if cooling type R (without internal heat exchanger) is selected.

There are wall mounting and outside cabinet mounting possible.

Type Key

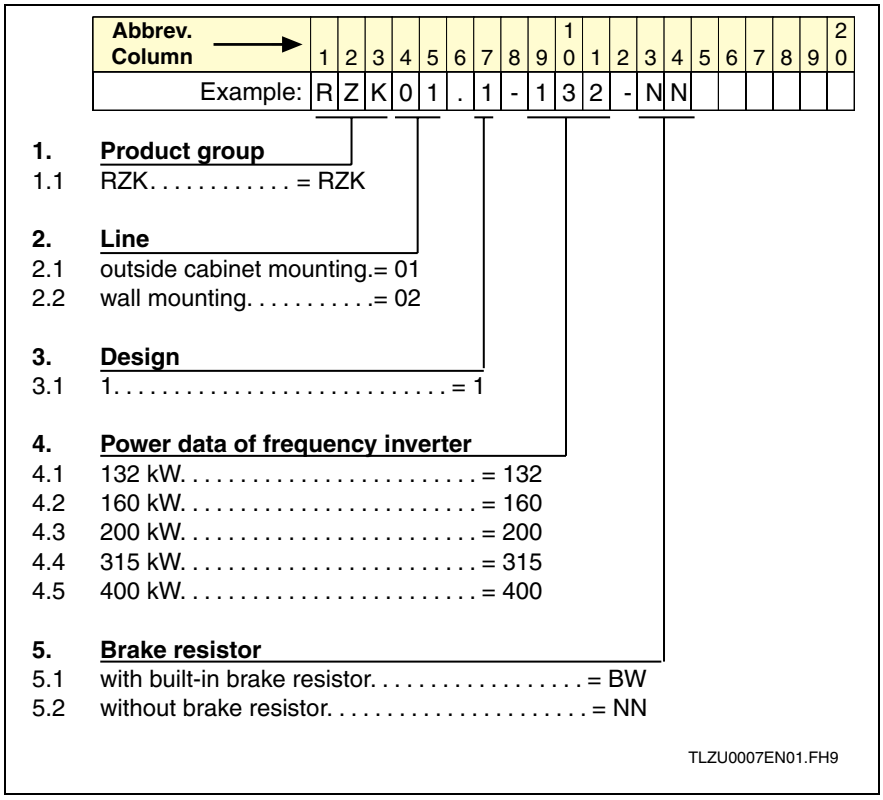


Fig.: 5-1 Type keys of external heat exchangers

Note: Protection class IP 20

Technical Data

	Heat exchanger data		Braking resistance data			
Power class / code, kW	**Cooling power, kW**	**Weight kg**	**Resistance Ω**	**Nominal power, kW**	**Peak power for 0.1 s, kW**	**Thermal time constant TBW, s**
132 / 160	4	16	2,2	2	270	13,6
200	5	23	1,6	2,5	370	14,3
315	2 x 4	2 x 16	2 x 2.2	2 x 2	2 x 270	13,6
400	2 x 5	2 x 23	2 x 1.6	2 x 2.5	2 x 370	14,3

Tab. 5-1 Technical data

Type Label

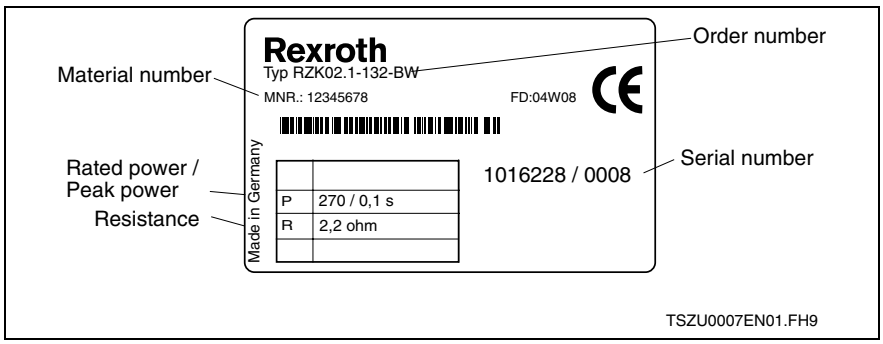


Fig.: 5-2 Type label for RZK02.1

5.2 Operation

Warning

WARNING

Burns due to hot components with temperatures above 30 °C!

⇒ During operation, the braking resistance increases according to the braking power. This can heat the surface of the housing up to 80 °C.

⇒ Personnel that work on the open switch cabinet or in the switching space must note that the braking resistors are exposed.

Settings on Converter

Before the braking resistor is commissioned, it must be checked whether parameter P0036 is set to “Standard” (factory setting). The converter then monitors the external standard braking resistor by calculating a thermal portrayal during operation with the internally stored power data of the braking resistor.

Parameter number	Parameter name	Parameter value
P0036	Braking resistance	Standard

Tab. 5-2 Affected parameters

Calculation of Load

Depending on the relationship of the average braking power P_{Bm} to the continuous power P_D of the braking resistor, the maximum permitted braking time t_{Bmax} and the braking time t_P that may be required can be determined using the load diagram Fig.: 5-7. At a peak power P_B, the average braking power P_{Bm} is defined as follows:

For Braking Procedures when Stopping and Reversing

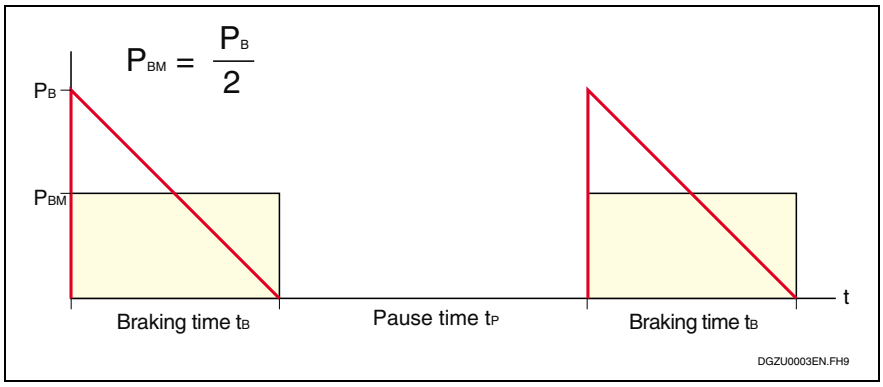


Fig.: 5-3 Load diagram for stopping and reversing

The energy required for stopping is determined by the technological arrangement.

Therefore, the required braking power is affected by the selected braking time.

Decreasing the braking time increases the braking power while increasing the braking time decreases the braking power.

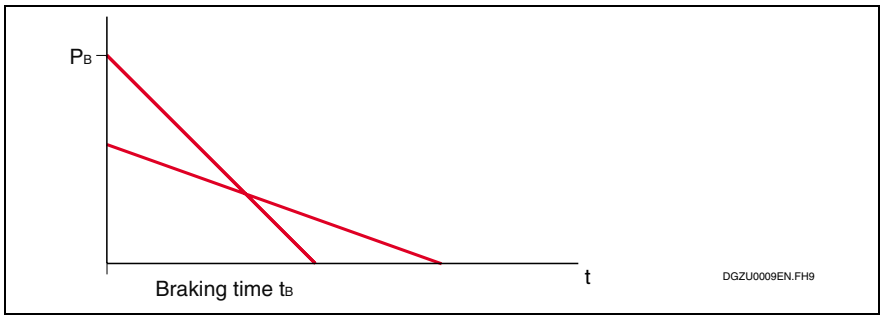


Fig. 5-4: Effect of braking time on braking power

For Dynamic Operation at Constant Speed

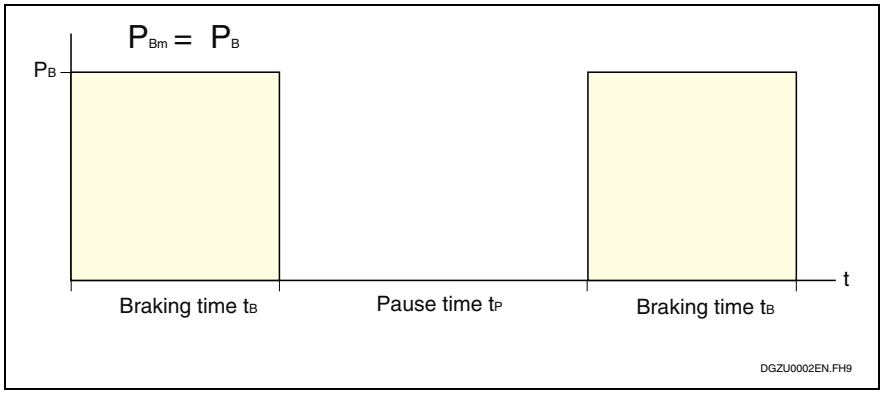


Fig.: 5-5 Load diagram for dynamic operation

Load Diagram

The load diagram is used to determine the permitted braking times and required pause times depending on the relationship of the average braking power P_{BM} to the continuous power P_D of the utilized braking resistor that was calculated above.

Determining the Maximum Permitted Braking Time t_{Bmax}

Starting at power class 132, the thermal time constant of the standard resistors are indicated as a characteristic curve in diagram 1 above. Using the relationship of the average braking power P_{Bm} to the continuous power P_D of the utilized resistor, you go to the right from the y-axis to the characteristic curve, then read the value for the maximum braking time t_{Bmax} below the intersection on the x-axis.

Determining the Required Pause Time t_P

A family of characteristic curves is indicated for various P_{Bm} / P_D relationships in diagram 2 below. Using the braking time that is actually used, you go to the P_{Bm} / P_D characteristic curve and then read the required pause time t_P from the y-axis.

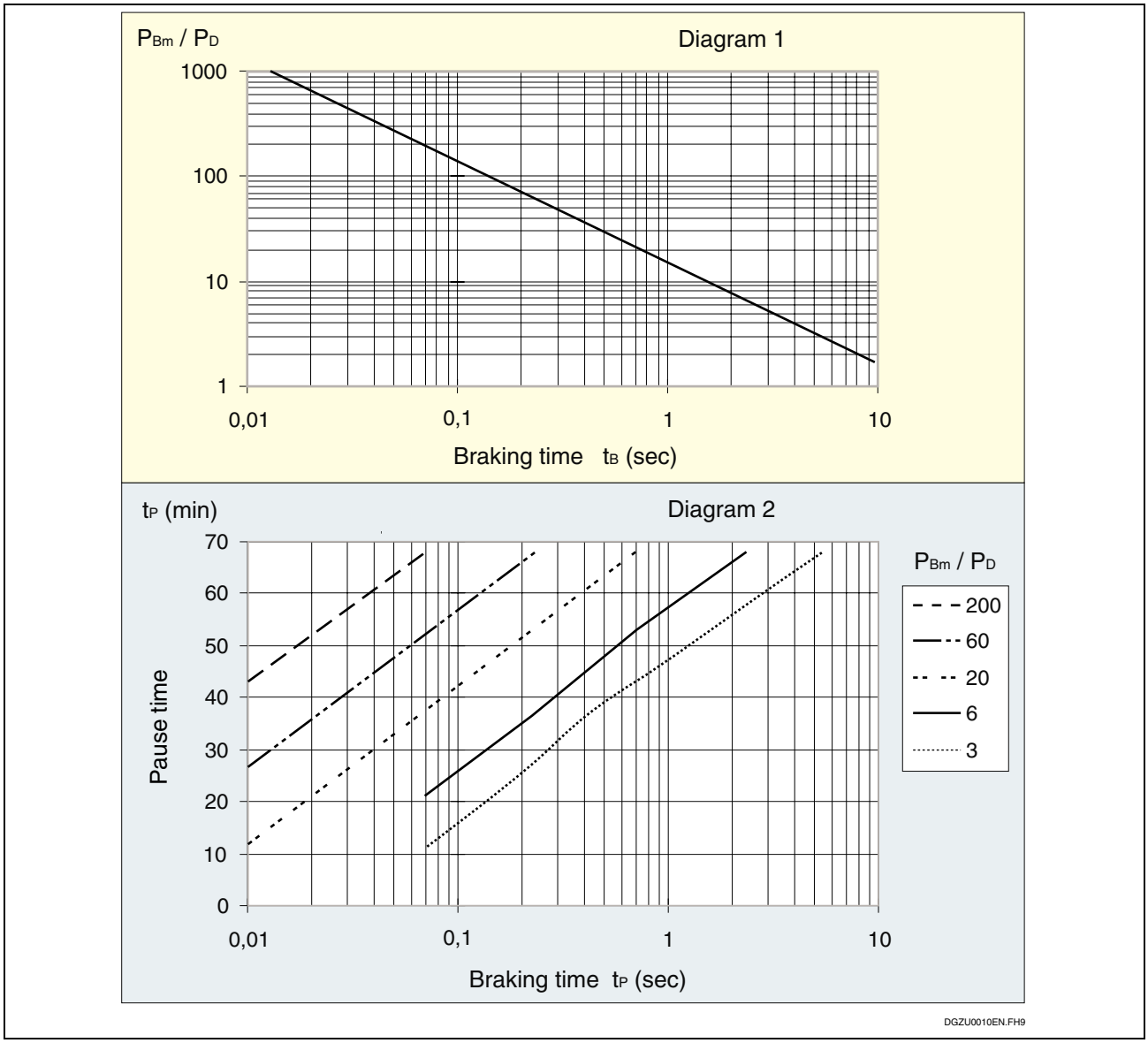


Fig.: 5-6 Load diagram for braking resistors

Sample Calculation

Using braking resistor RZK01.1-132:

P_{max} = 270 kW

P_D = 2 kW

1. Stopping from nominal speed

Assumption: A peak power P_B of 12 kW is required to stop in 5 s.

Calculation: The average braking power is:

$P_{Bm} = P_B / 2 = 12 kW / 2 = 6 kW$

The relationship of the average braking power to the continuous power is: $P_{Bm} / P_D = 6 KW / 2 kW = 3$

Using this value, the maximum possible braking time t_{Bmax} = 5.5 sec is taken from diagram 1. The condition for the desired braking time is met.

Using the actual braking time of 5 sec, you now go to the theoretical $P_{Bm} / P_D = 3$ characteristic curve in diagram 2 and then read the required pause time t_P = 67 sec from the y-axis. Utilizing the maximum braking time of 5.5 sec would require a pause time of 68 sec.

2. Dynamic operation at constant speed

Calculation: The average braking power is: $P_{Bm} = P_B = 114 kW$

The relationship of the average braking power to the continuous power is: $P_{Bm} / P_D = 114 KW / 2 kW = 57$

Using this value, the maximum possible braking time t_{Bmax} = 0.24 sec is taken from diagram 1. The required pause time t_P = 68 sec results from diagram 2.

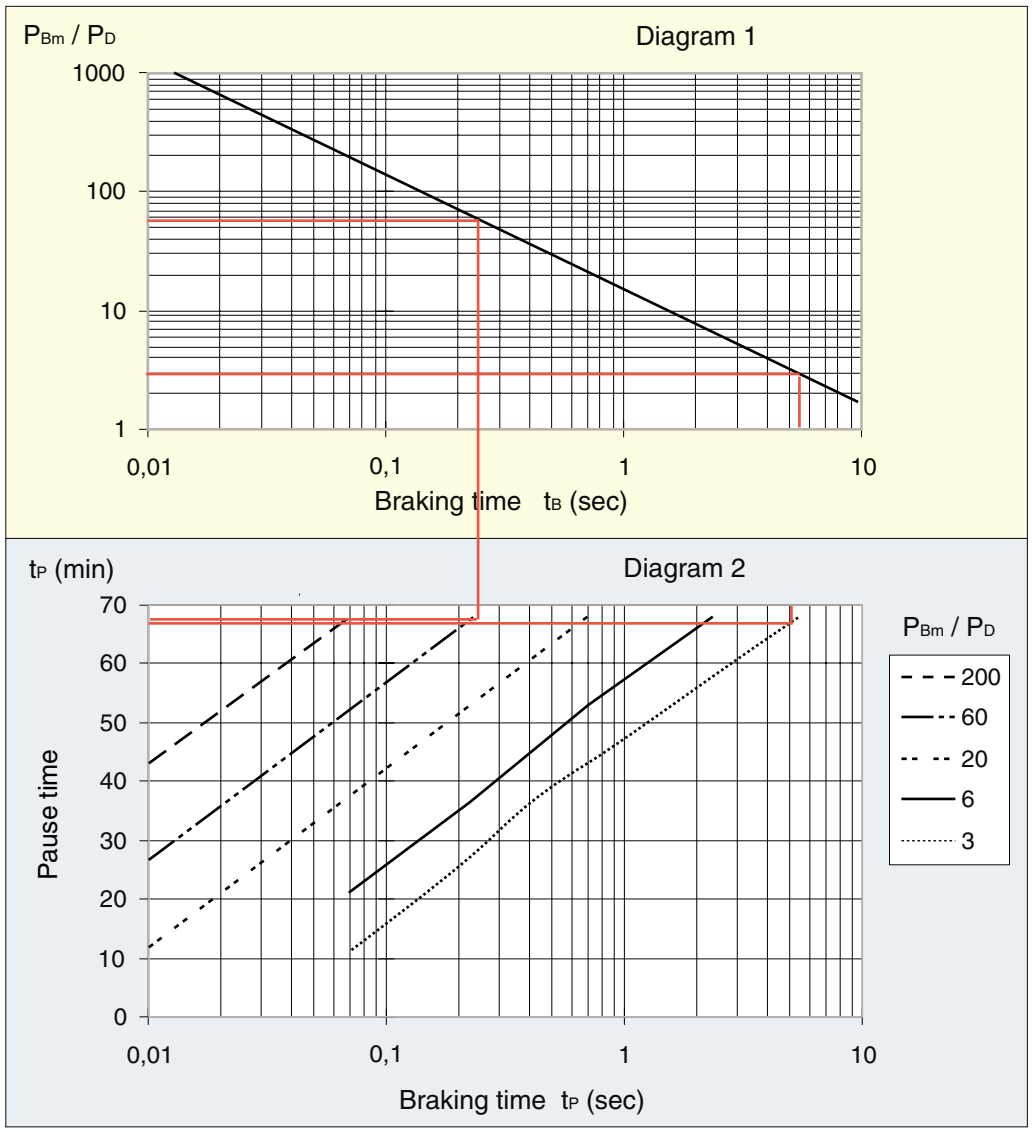


Fig.: 5-7 Sample calculation with load diagram for braking resistor

Note: The peak power is available for only 0.1 second

Malfunction During Braking Operation

When the limit values for the thermal portrayal of the standard braking resistors are exceeded, the converter shuts down with error “BR overload” to protect the braking resistor from being overloaded.

Possible cause of error	Remedy
P0036 is set to “Standard” although no braking resistor is connected.	Switch P0036 to “off”.
Incorrect braking resistor connected.	Check whether the correct braking resistor is connected; see the Technical Data in section 5.1 Technical Data.
Descending ramp too fast	Set a longer descent time.
The resistance is too high due to a defect.	Check the resistance with a suitable measuring instrument; see the Technical Data in section 5.1 Technical Data.
Incorrect relationship of braking and pause times.	To determine the braking and pause times, use the load calculation in section 5.2.

Tab. 5-3 Causes of errors

5.3 Mechanical Assembly

General Notes Regarding Assembly

In externally assembled heat exchangers, the converter is not cooled by the air flow of the heat exchanger.

- Assembly must be carried out perpendicular to a level construction area.
- To ensure that the warm exhaust air can flow without impedance, a space with a height of at least 200 mm must be maintained above the devices.
- The fastening screws are shown in the drilling templates of the dimension drawings.
- Attach the external heat exchanger to the desired location. Connect the coolant circulation of the converter with the heat exchanger using the coolant hoses. Depending on the requirements, the coolant hoses must be included in the order. Your distributor can provide you with further information regarding coolant hoses, hose nozzles, couplings, angular connections, etc.

Dimension Drawing of External Heat Exchanger for Outside Cabinet mounting RZK01.1

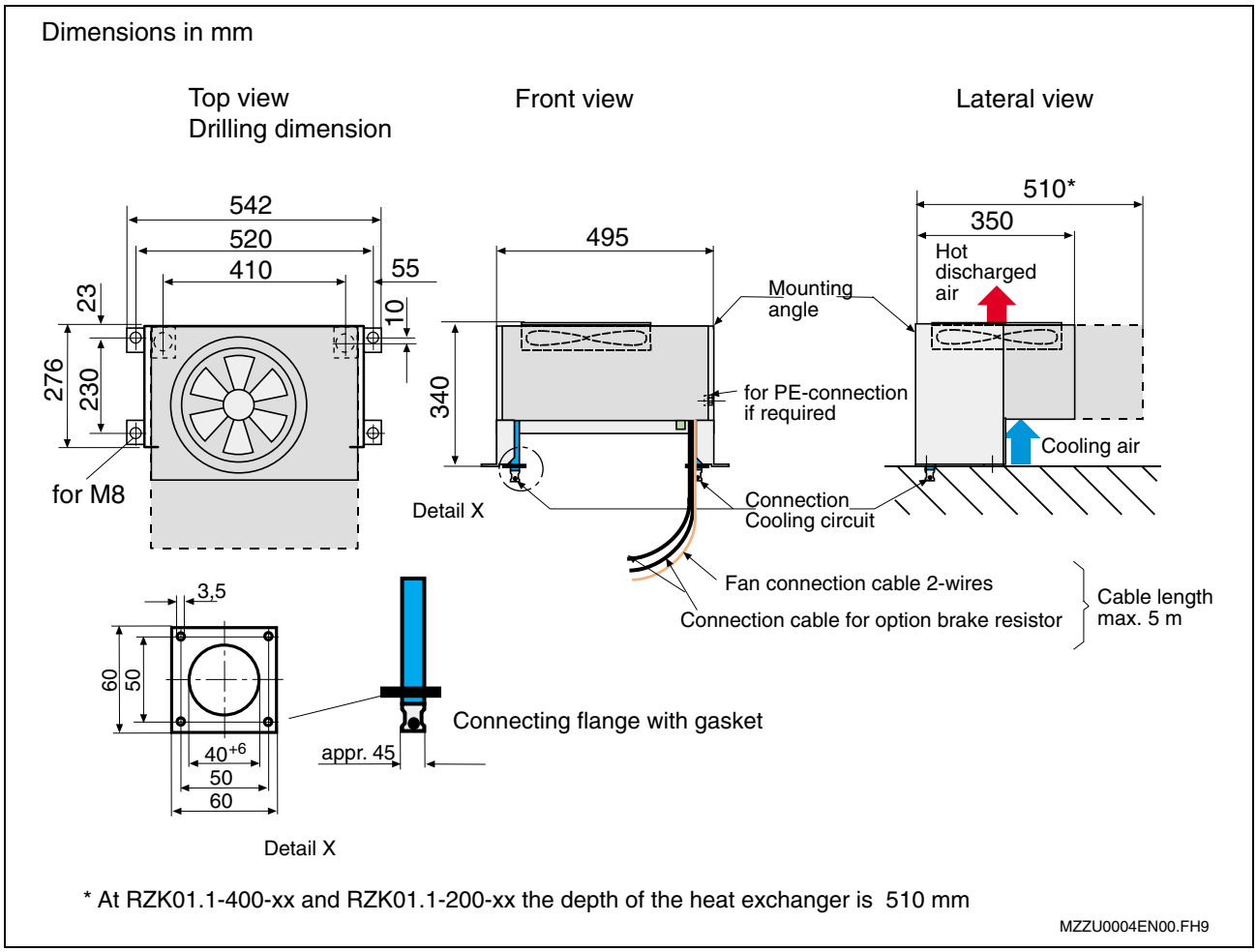


Fig.: 5-8 Heat exchanger for outside cabinet mounting

Dimension Drawing of External Heat Exchanger for Wall Mounting RZK02.1

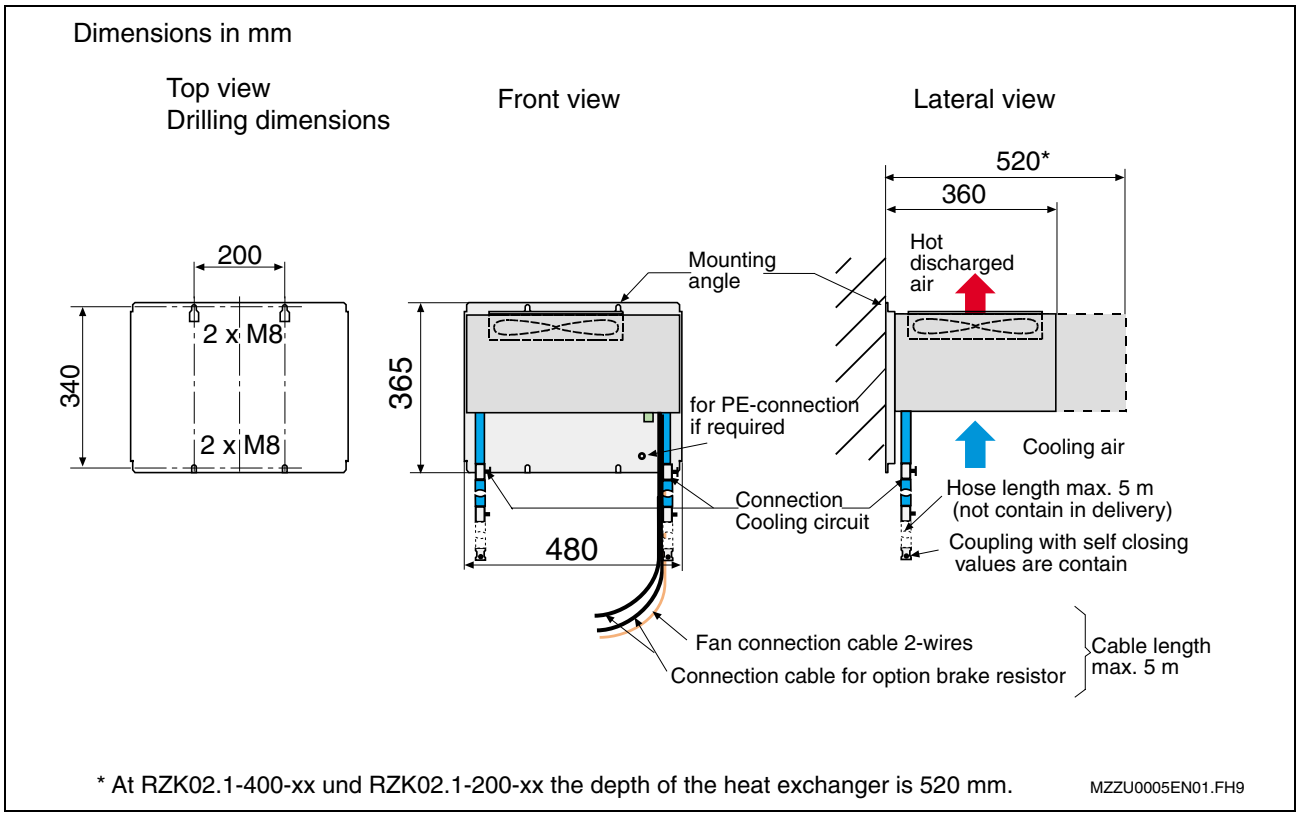


Fig.: 5-9 Heat exchanger for wall mounting

Note: The maximum assembly spacing from the wall is 5 m.

Minimum Spacing

The spacing for cooling air and the warm exhaust air must be maintained.

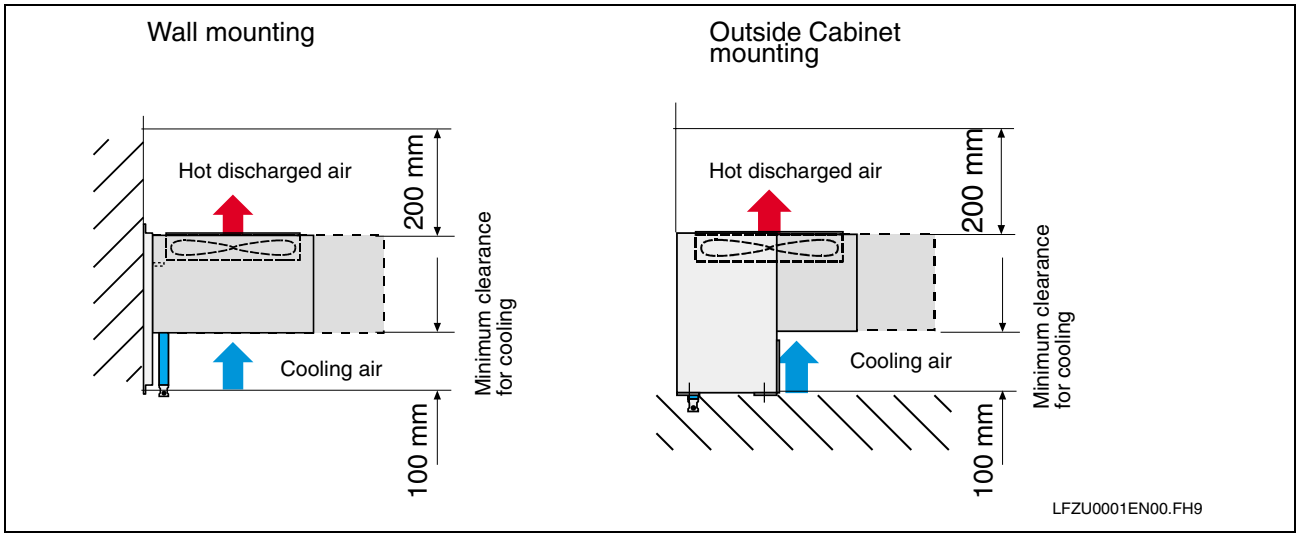


Fig.: 5-10 Minimum spacing for cooling

PE connection

Grounding for outside cabinet mounting is executed either: via the cabinet roof; in this case, the ground connection via the fastening screws must be ensured using a contact or scraper disc.

- or -

on the PE connection on the exterior of the heat exchanger.

Note: Ensure a sufficient minimum cross-section of the grounded conductor according to DIN VDE 0298, Part 4 / VDE 0100, Page 258 – Allocation of the grounded conductor.

Heed the following for the option of an external braking resistor with a heat exchanger.

- The short-circuit-protected cable is of type NSGAFÖU
- The connection cross-sections and grounded conductor cross-sections can be found in the table.

Power class kW	Number of heat exchaners	Size class of FU	Cross-section for BR line, mm²	Recommended cross-section for grounded conductor, mm²
132	1 x 132	G	2 x 16	1 x 16 (AWG 4)
160	1 x 160	G	2 x 16	1 x 16 (AWG 4)
200	1 x 200	G	2 x 16	1 x 16 (AWG 4)
315	2 x 160	H	4 x 16	2 x 16 (AWG 4)
400	2 x 200	H	4 x 16	2 x 16 (AWG 4)

Tab. 5-4: Line cross-section for braking resistor option

5.4 Connection

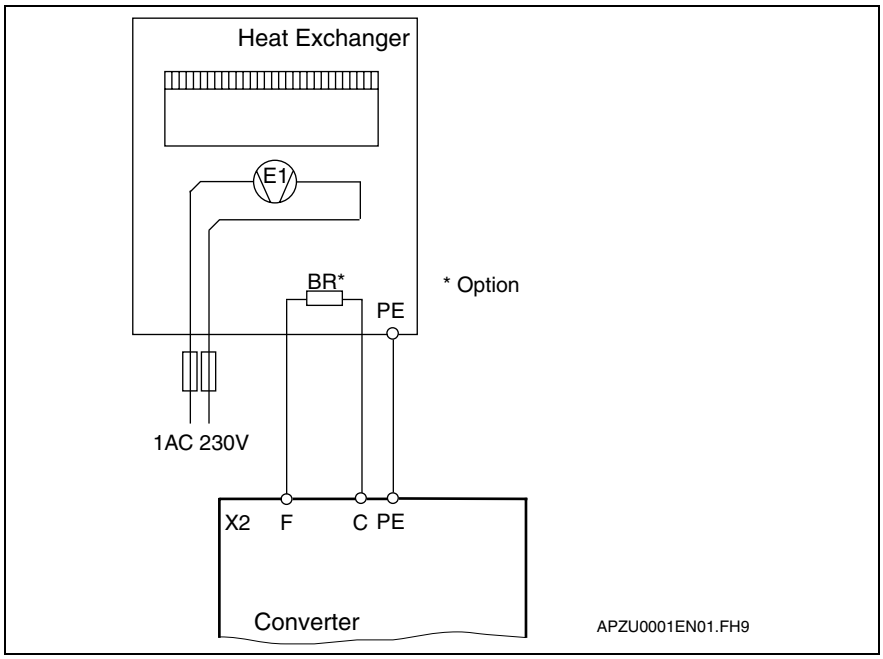


Fig.: 5-11 Connection of heat exchanger

As many frequency converters can be connected to the heat exchanger as desired, as long as the sum of all individual converter losses does not exceed the cooling power.

6 RZM01.1 Motor Filter

6.1 Description of the Motor Filter

The steep switching flanks of modern pulse converters, combined with long motor lines, lead to transient excess voltages on the motor terminals. When a motor filter is used on the converter output, these excess voltages are reduced to harmless levels and the leakage currents of the motor lines decrease.

This provides the following advantages:

- Limitation of power surges and the peak value for reducing strain on the winding insulation.
- Operation of motors using long supply lines or many parallel motor lines (e.g. for group drives).
- Reduction of interfering voltages on the motor line in the case of increased EMC requirements.

Type Key

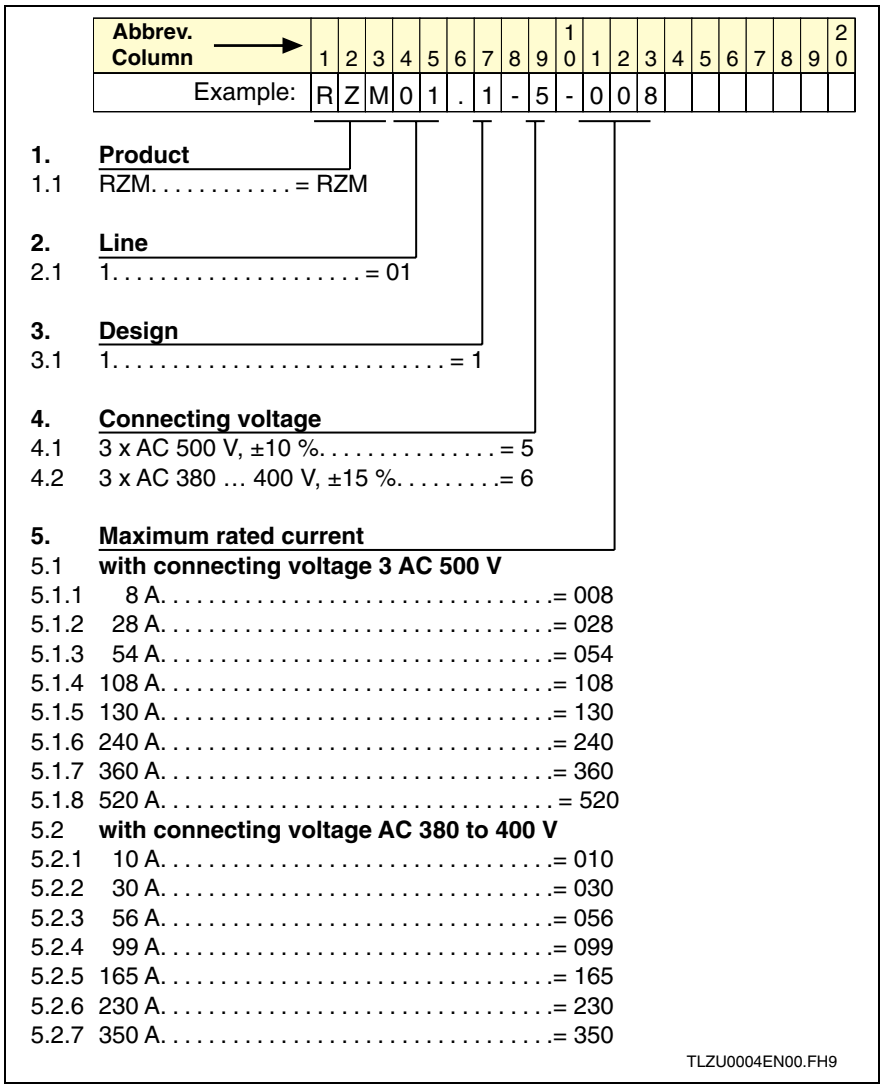


Fig.: 6-1 Type key for motor filter

Presentation of Principle

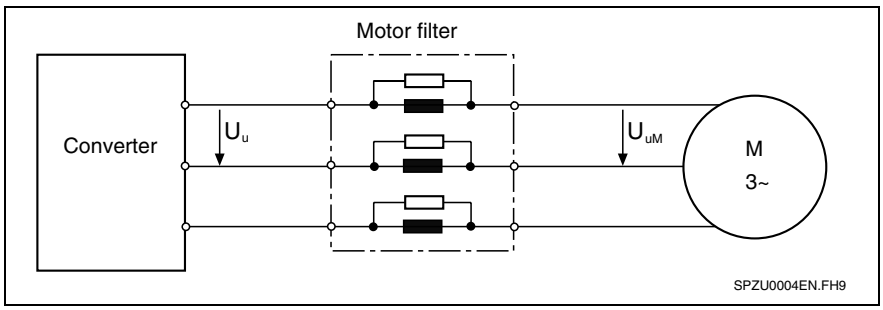


Fig.: 6-2 Switching principle of motor filter

Voltage at Motor

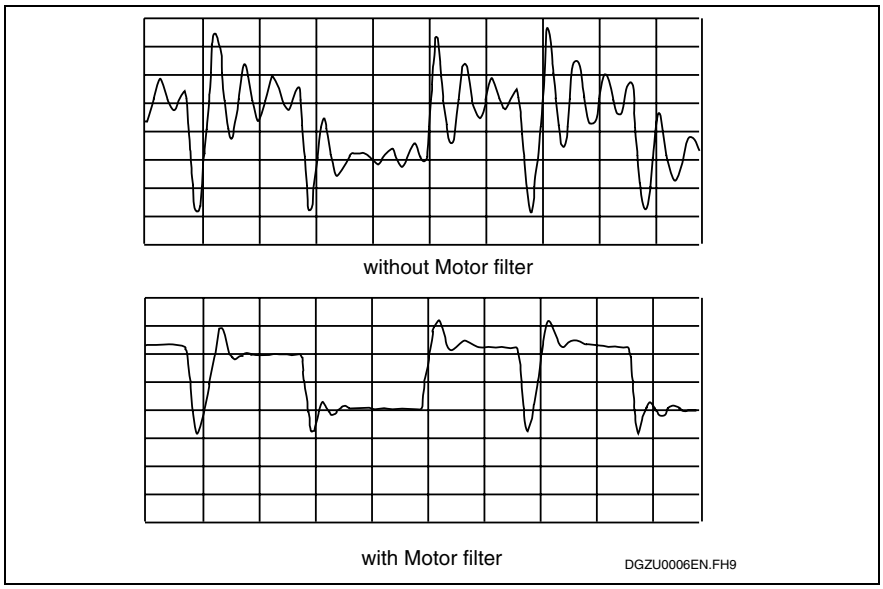


Fig.: 6-3 Voltage diagram for motor filter

Technical Data

Motor Filters for 380 V ... 400 V Connection Voltage

Pulse frequency fp = 8 kHz:

- Maximum output frequency 200 Hz.
- Maximum line length 150 m (sum of all connected motor cables). If the lines are shielded, the line lengths provided are to be reduced by 50 %.

Pulse frequency fp = 4 kHz:

- Maximum output frequency 100 Hz.
- Maximum line length 300 m (sum of all connected motor cables). If the lines are shielded, the line lengths provided are to be reduced by 50 %.

Converter					Motor filter RZM01.1-6-...
Power class	**Power code**	**Nominal current at 4 kHz, A**	**Nominal current at 8 kHz, A**	**Power loss, W**	**Designation**
1.5 / 3.0 / 4.0	010	10	7.5	120	RZM01.1-6-010
5.5 / 7.5 / 011 / 015	030	30	25	160	RZM01.1-6-030
018 / 022 / 030	056	56	43	220	RZM01.1-6-056
037 / 045 / 055	099	99	82	280	RZM01.1-6-099
075 / 090	165	165	135	400	RZM01.1-6-165
110 / 132	230	230	195	600	RZM01.1-6-230
160 / 200	350	350	280	800	RZM01.1-6-350

Tab.: 6-1 Technical data RZM01.1-6-...

Motor Filters for 500 V Connection Voltage

Pulse frequency fp = 8 kHz:

- Maximum output frequency 200 Hz.
- Maximum line length 120 m (sum of all connected motor cables). If the lines are shielded, the line lengths provided are to be reduced by 50 %.

Pulse frequency fp = 4 kHz:

- Maximum output frequency 100 Hz.
- Maximum line length 200 m (sum of all connected motor cables). If the lines are shielded, the line lengths provided are to be reduced by 50 %.

Converter					Motor filter RZM01.1-5-...
Power class	**Power code**	**Nominal current at 4 kHz, A**	**Nominal current at 8 kHz, A**	**Power loss, W**	**Designation**
1.5 / 3.0 / 4.0 / 5.5	008	8	6	140	RZM01.1-5-008
7.5 / 011 / 015 / 018	028	28	24	190	RZM01.1-5-028
22 / 30 / 37	054	54	45	250	RZM01.1-5-054
045 / 055 / 075	108	108	80	440	RZM01.1-5-108*)
090	130	130	108	650	RZM01.1-5-130*)

*) Order converter / inverter with auxiliary function L1

Tab.: 6-2 Technical data RZM01.1-5-...

Type Label

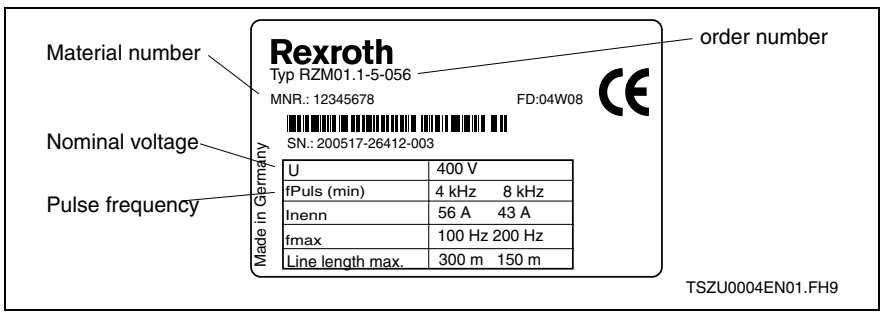
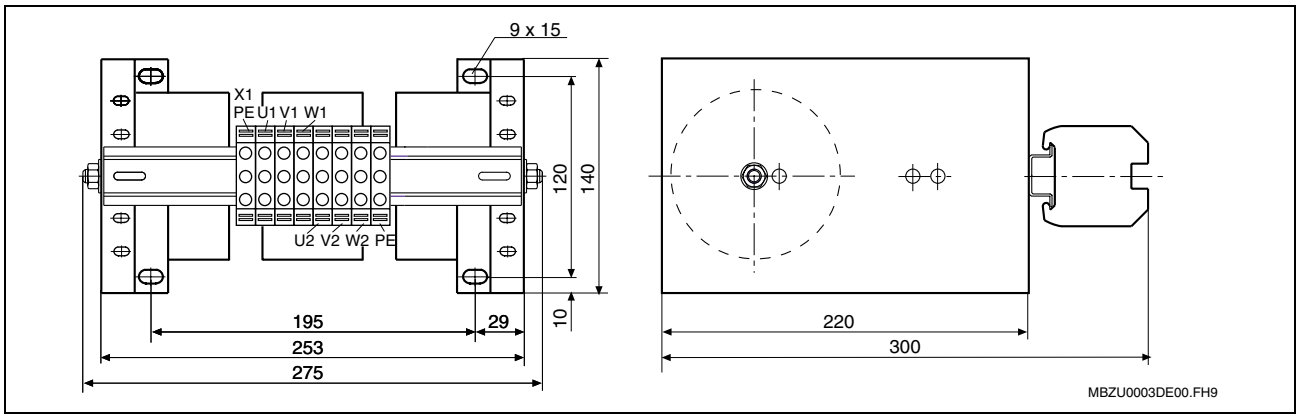


Fig.: 6-4 Type label for motor filter

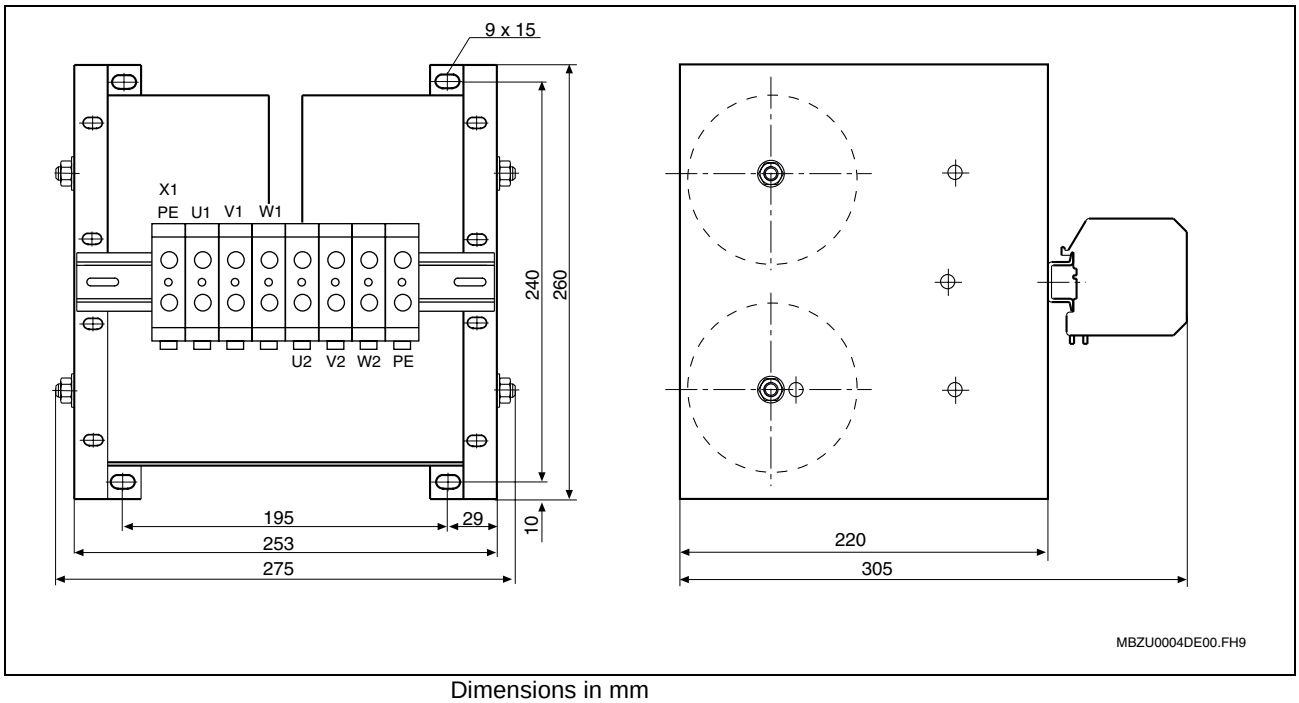
6.2 Mechanical Assembly

Dimension Drawings



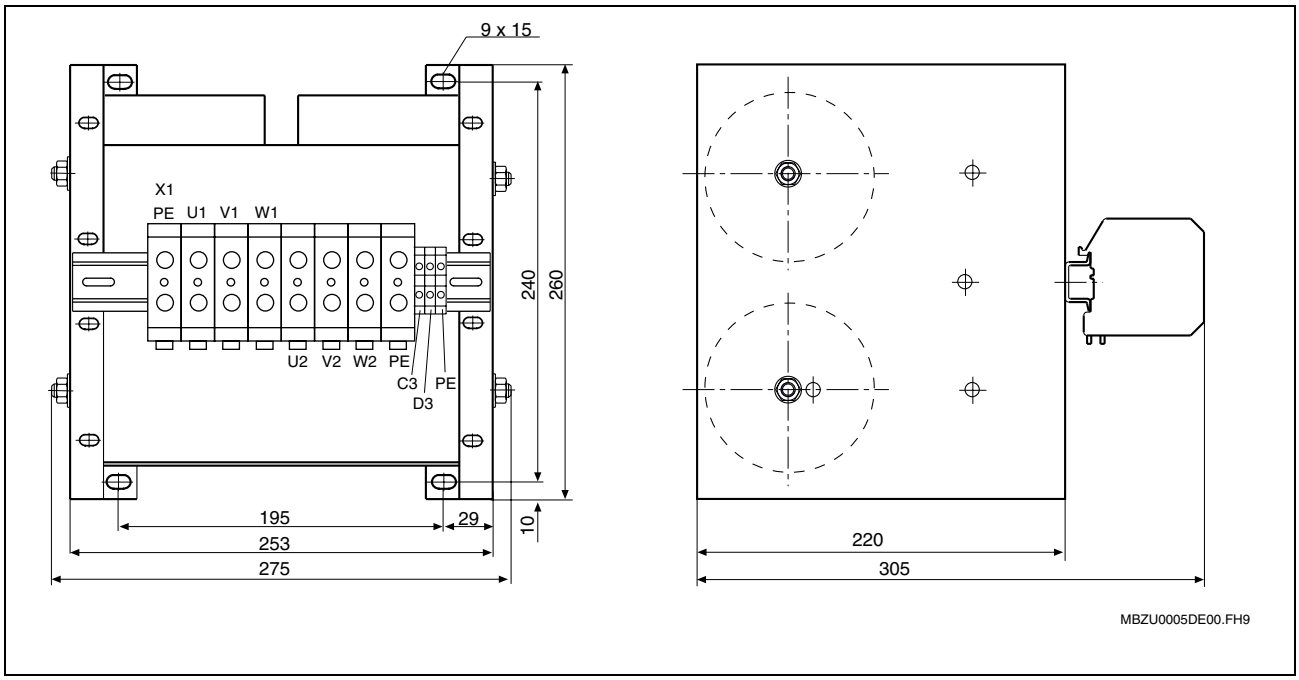
Dimensions in mm

Fig.: 6-5 Dimension sheet for motor filters 010 / 030 / 056 / 008 / 028



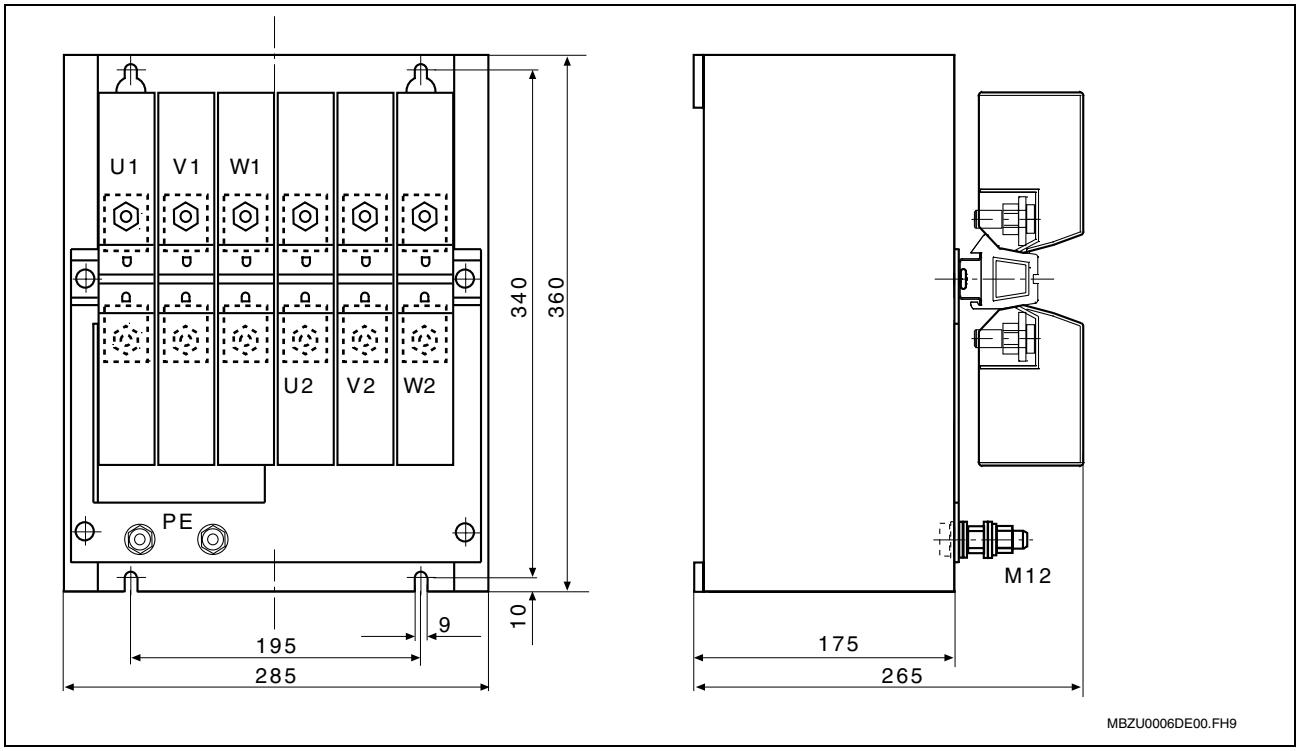
Dimensions in mm

Fig.: 6-6 Dimension sheet for motor filters 099 / 054



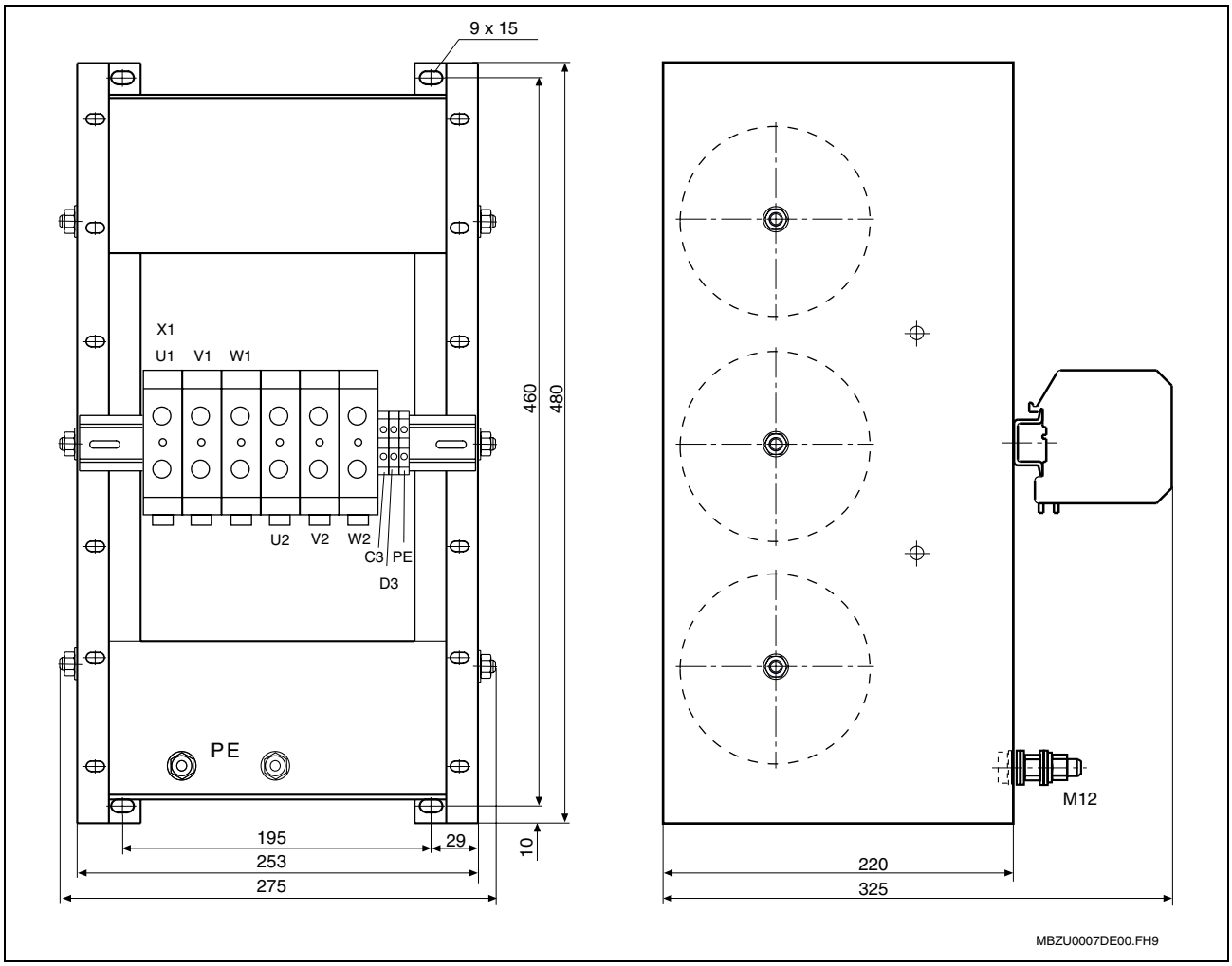
Dimensions in mm

Fig.: 6-7 Dimension sheet for motor filter 108



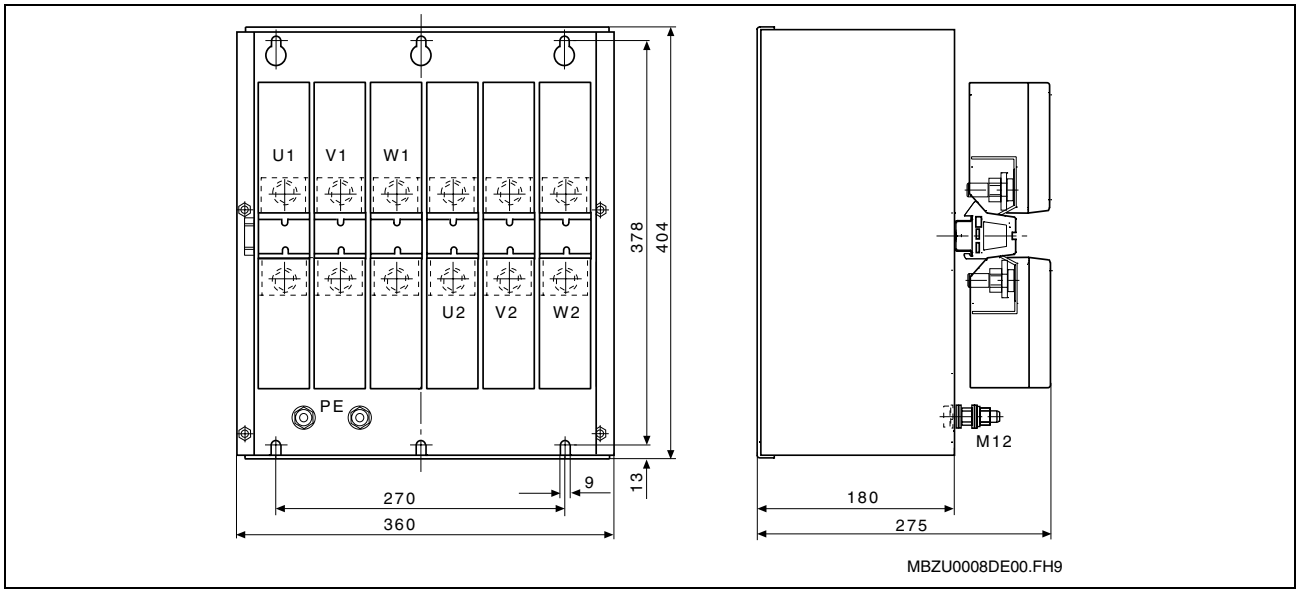
Dimensions in mm

Fig.: 6-8 Dimension sheet for motor filters 165 / 230



Dimensions in mm

Fig.: 6-9 Dimension sheet for motor filter 130



Dimensions in mm

Fig.: 6-10 Dimension sheet for motor filter 350

6.3 Connection

U1, V1, W1: Input of the motor filter
U2, V2, W2: Output of the motor filter

Connection Examples

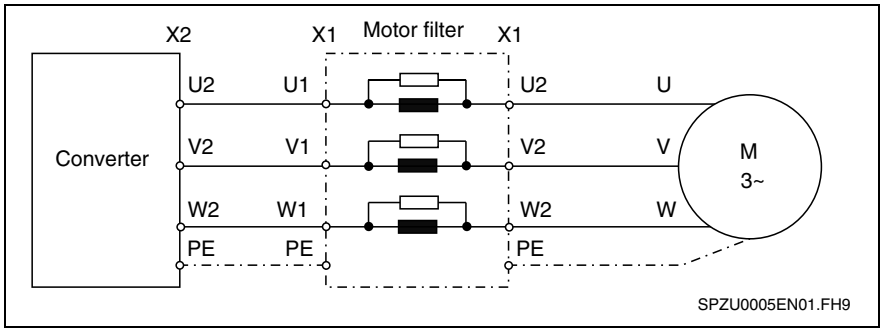


Fig.: 6-11 Connection circuit diagram: 010 / 030 / 056 / 099 / 165 / 230 / 350 / 008 / 028 / 054

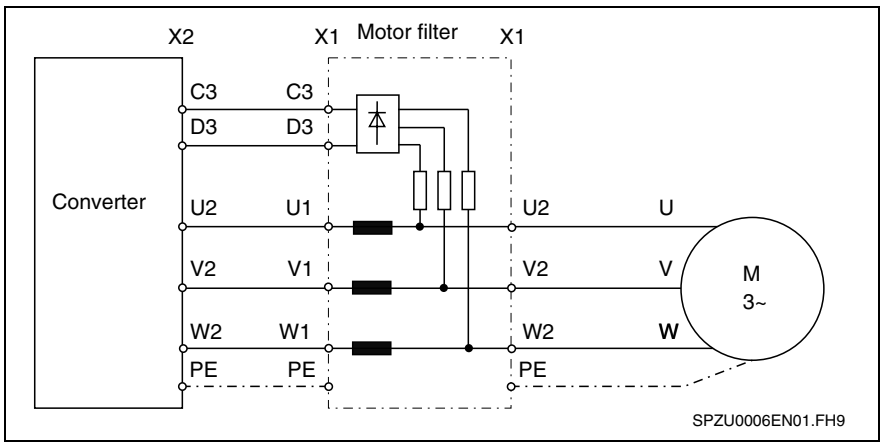


Fig.: 6-12 Connection circuit diagram: 108 / 130

WARNING

Damage to property due to component overload!

⇒ Connection C3, D3 to converter must be manufactured. The filter could be destroyed.

As use as Motor filter RZM01.1-5-108 and RZM01.1-5-130 auxiliary function L1 must be present at converter.

Following cross section are observed:

Size class	Cable cross section
C	4 mm²
D	6 mm²
E	10 mm²

Tab.: 6-13: Cable cross section for cable connection C3 and D3

Converting the Pulse Frequency

The motor filter can be used for converters with a pulse frequency of f_p = 4 kHz to f_p = 8 kHz.

The pulse frequency is converted using parameter P0026 (see the operating instructions: device control / nominal values).

7 RZS01.1 Sinusoidal filter

7.1 Description of the Sinusoidal filter

Using the Sinusoidal filter, the motor is operated with sine-shaped current and voltage values.

This provides the following advantages:

- Limitation of power surges and the peak value for reducing strain on the winding insulation.
- Operation of motors using long supply lines or many parallel motor lines (e.g. for group drives).
- Reduction of excess losses in the motor, especially in the case of high speeds.
- Reduction of interfering voltages on the motor line in the case of increased EMC requirements.

The Sinusoidal filter is designed as a three-phase LC filter.

Type Key

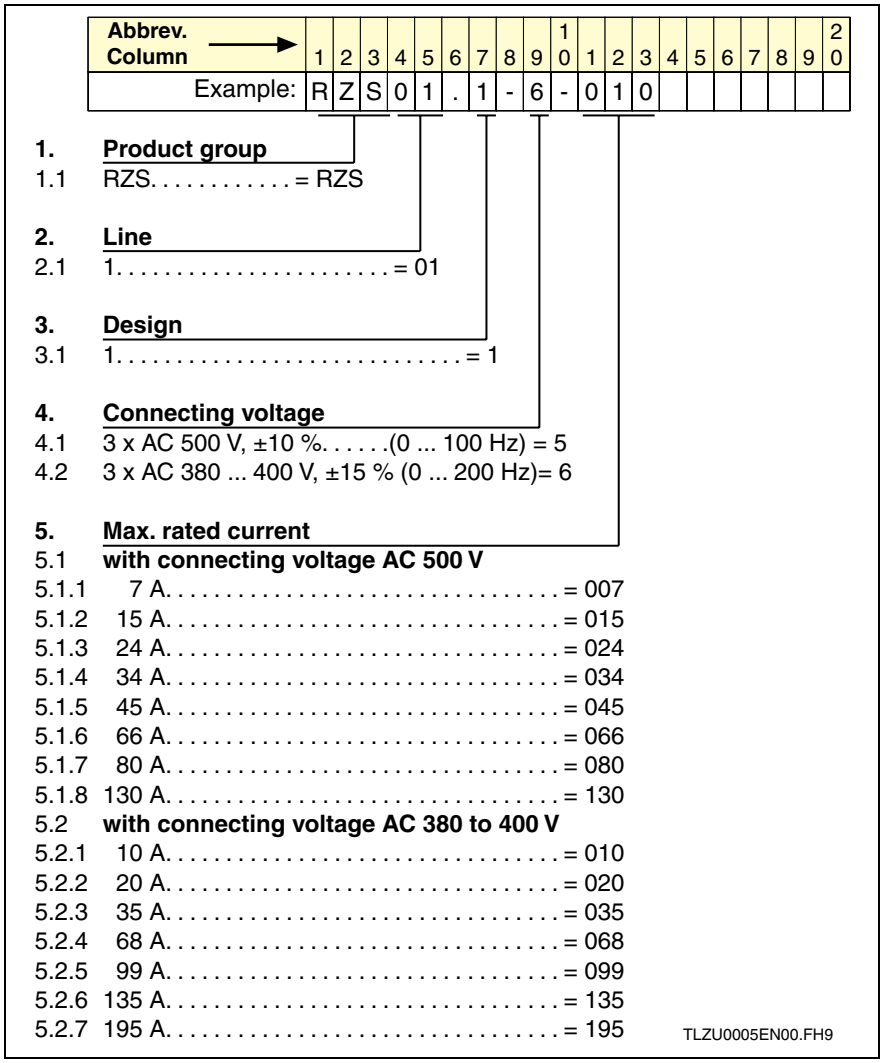


Fig.: 7-1 Type key of Sinusoidal filter

Presentation of Principle

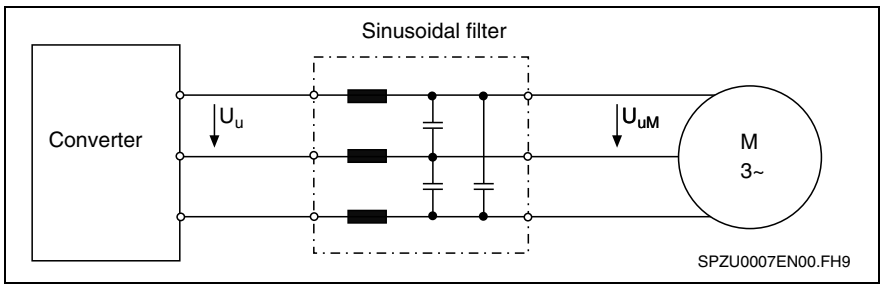


Fig. 7-2: Switching principle of Sinusoidal filter

Output Voltage of the Converter and Motor Voltage

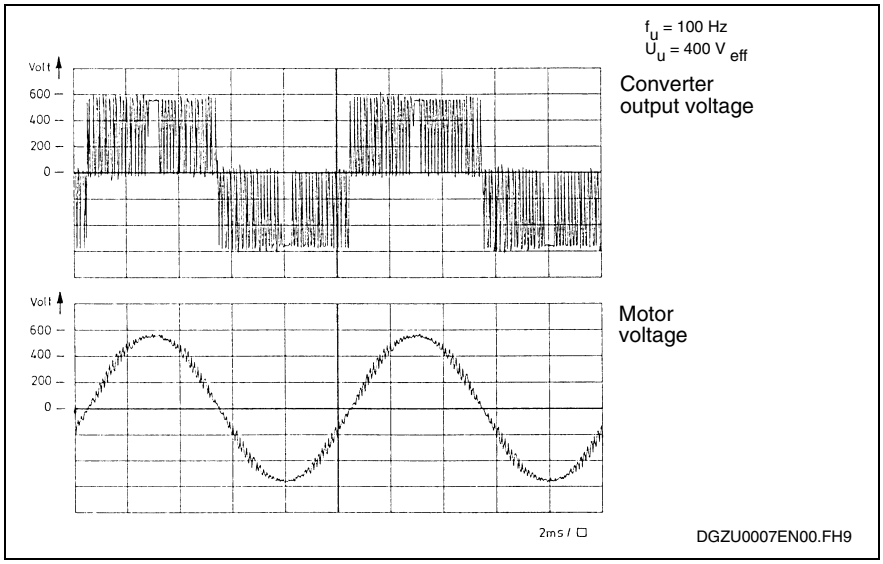


Fig.: 7-3 Voltage diagram of Sinusoidal filter

Technical Data

Sinusoidal filters for 380 V ... 400 V Connection Voltage

Pulse frequency fp = 8 kHz:

- Maximum output frequency 200 Hz.
- Maximum line length 400 m (sum of all connected motor cables). If the lines are shielded, the line lengths provided are to be reduced by 50 %.

Converter				Sinusoidal filter RZS01.1-6-...
Power class	**Power code**	**Nominal current, A**	**Power loss, W**	**Designation**
1.5 / 3.0 / 4.0 / 5.5	010	10	60	RZS01.1-6-010
7.5 / 011	020	20	120	RZS01.1-6-020
015 / 018 / 022	035	35	150	RZS01.1-6-035
030 / 037 / 045	068	68	200	RZS01.1-6-068
055 / 075	099	99	300	RZS01.1-6-099
090	135	135	400	RZS01.1-6-135
110 / 132	195	195	600	RZS01.1-6-195

Tab.: 7-1 Technical data of Sinusoidal filter for 380 V... 400 V

Sinusoidal filters for 500 V Connection Voltage

Pulse frequency fp = 8 kHz:

- Maximum output frequency 100 Hz.
- Maximum line length 400 m (sum of all connected motor cables). If the lines are shielded, the line lengths provided are to be reduced by 50 %.

Converter				Sinusoidal filter RZS01.1-5-...
Power class	**Power code**	**Nominal current, A**	**Power loss, W**	**Designation**
1.5 / 3.0 / 4.0	007	7	50	RZS01.1-5-007
5.5 / 7.5 / 011	015	15	80	RZS01.1-5-015
015 / 018	024	24	140	RZS01.1-5-024
022 / 030	034	34	180	RZS01.1-5-034
037	045	45	280	RZS01.1-5-045
045 / 055	066	66	360	RZS01.1-5-066
075	080	80	420	RZS01.1-5-080
090 / 110	130	130	640	RZS01.1-5-130

Tab.: 7-2 Technical data of Sinusoidal filter for 500 V

WARNING

Damages due to overloading of the component!

⇒ No pulse frequency lower than 8 kHz may be set in P0026. The filter could be destroyed.

Note: During operation with higher pulse frequencies, the permitted continuous currents are reduced.

Type Label

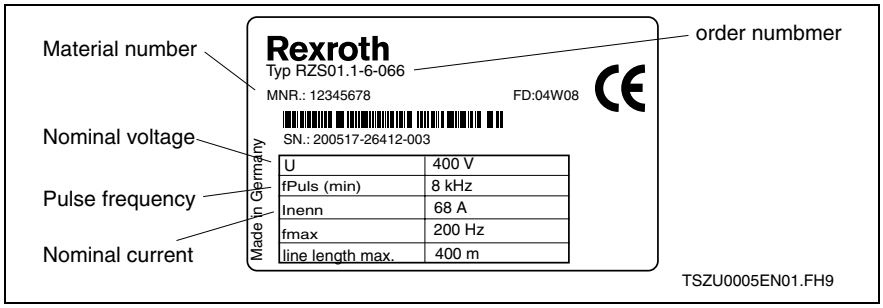


Fig.: 7-4 Type label of Sinusoidal filter

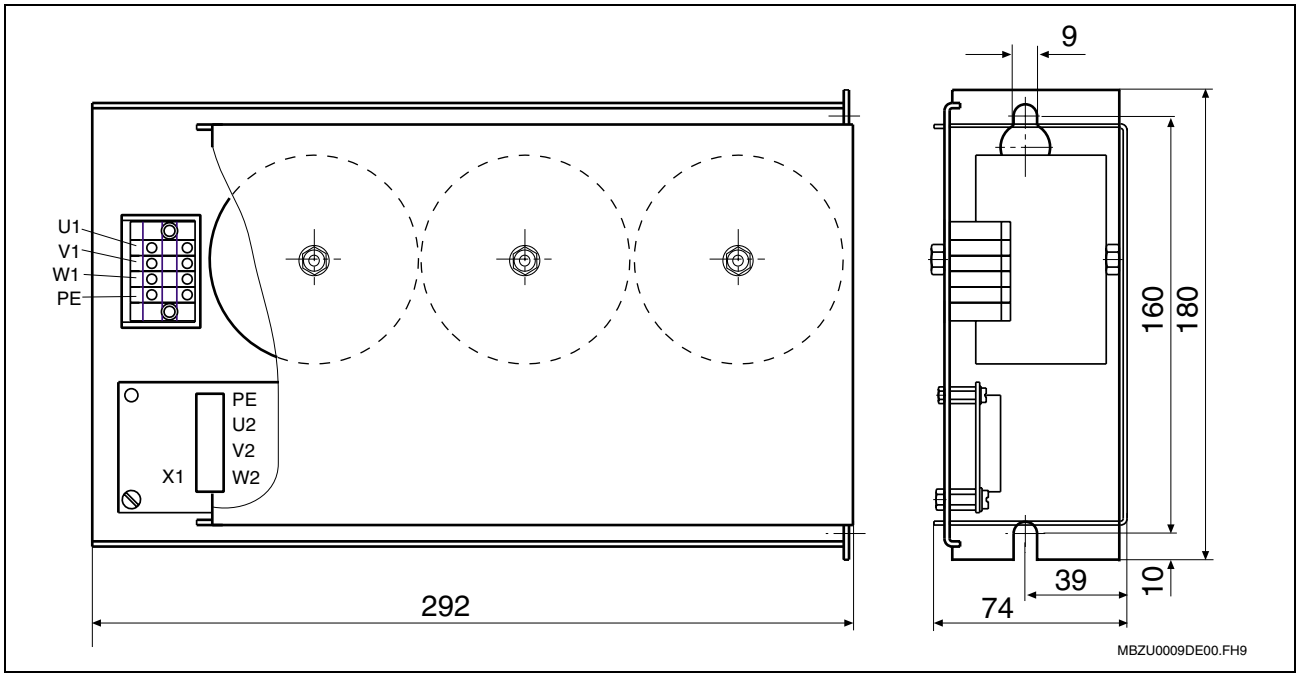
WARNING

Damages due to overloading of the component!

⇒ No lower pulse frequency may be set in P0026. The filter could be destroyed.

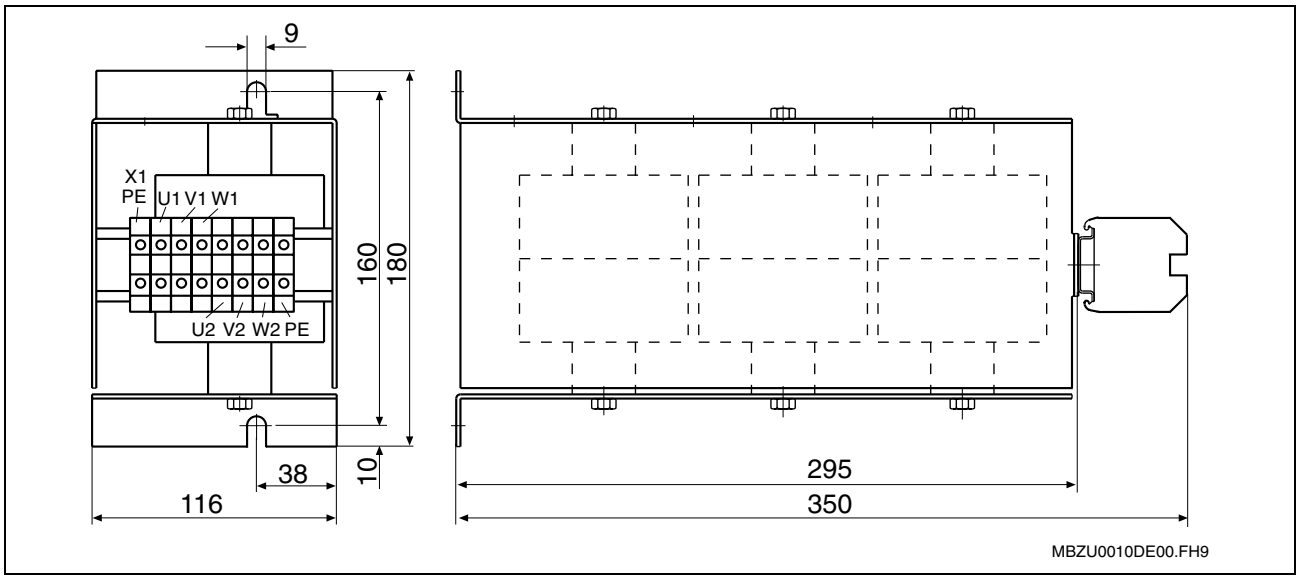
7.2 Mechanical Assembly

Dimension Drawings



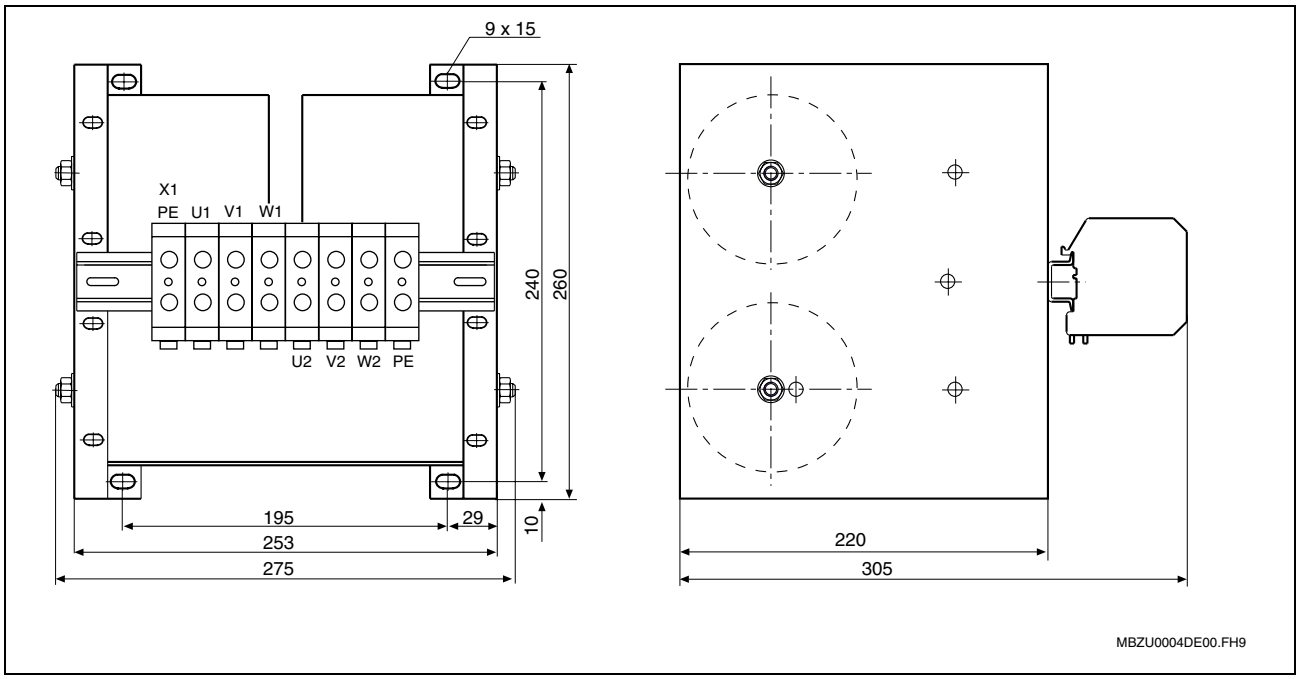
Dimension in mm

Fig.: 7-5 Dimension sheet of Sinusoidal filters 007 / 010



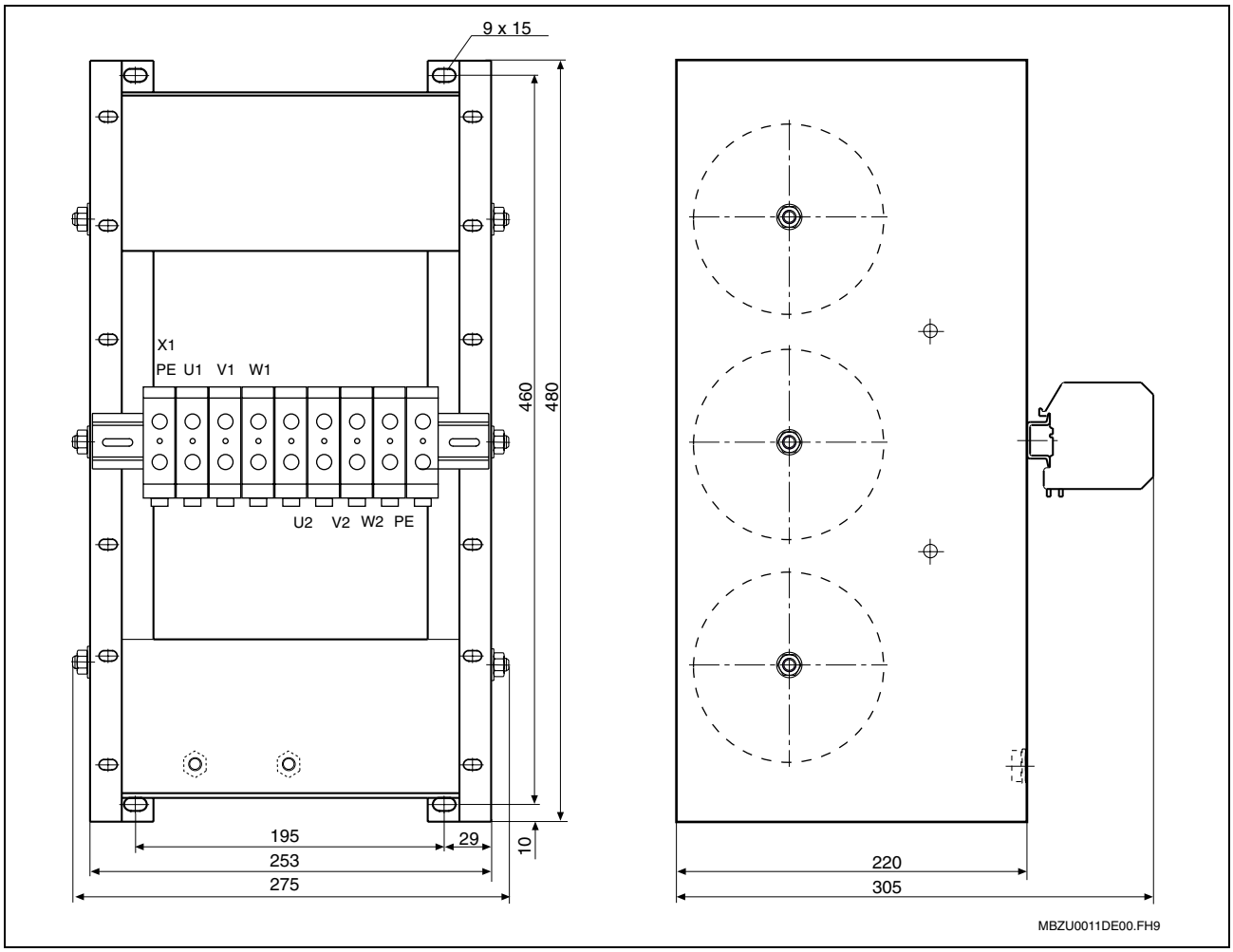
Dimension in mm

Fig.: 7-6 Dimension sheet of Sinusoidal filters 015 / 020



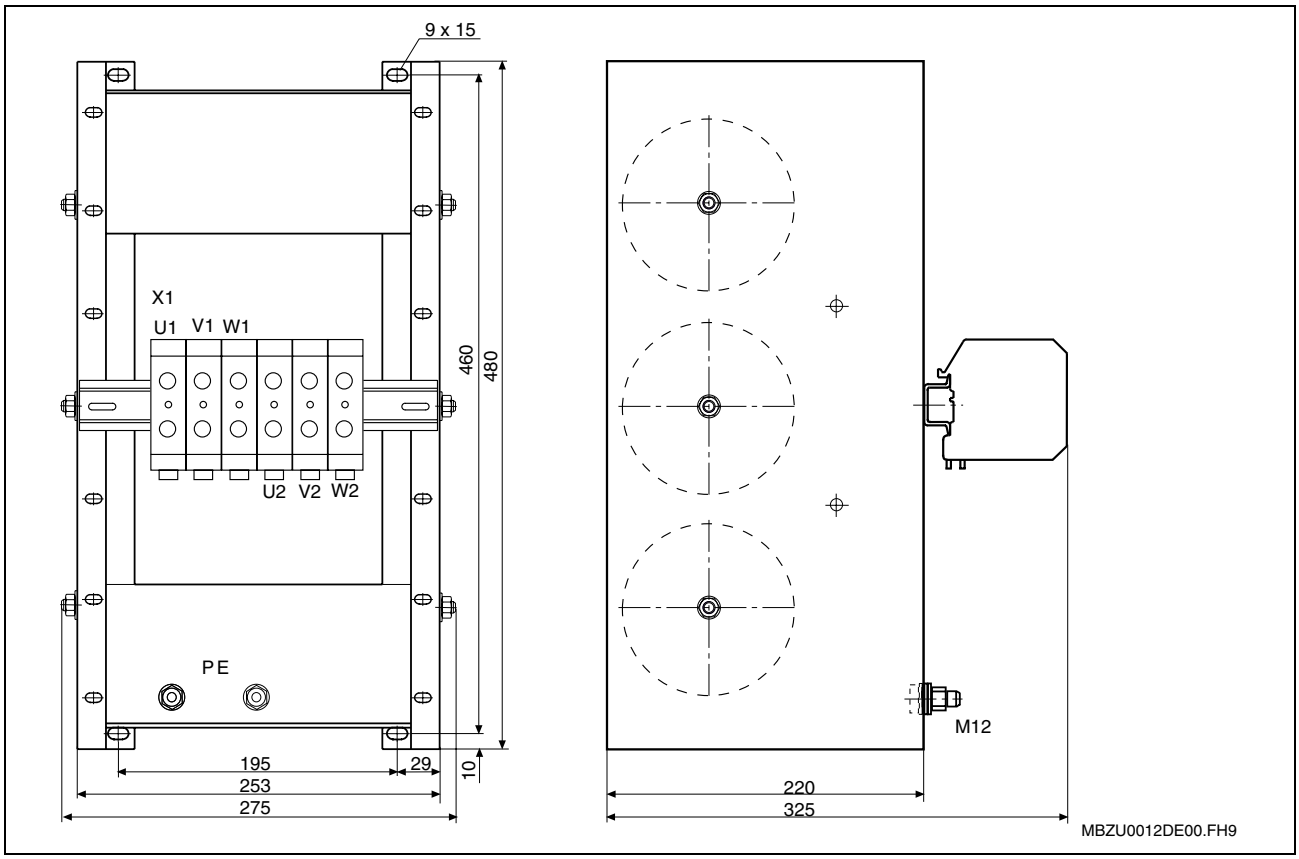
Dimension in mm

Fig.: 7-7 Dimension sheet of Sinusoidal filters 024 / 034 / 045 / 035 / 068 / 099



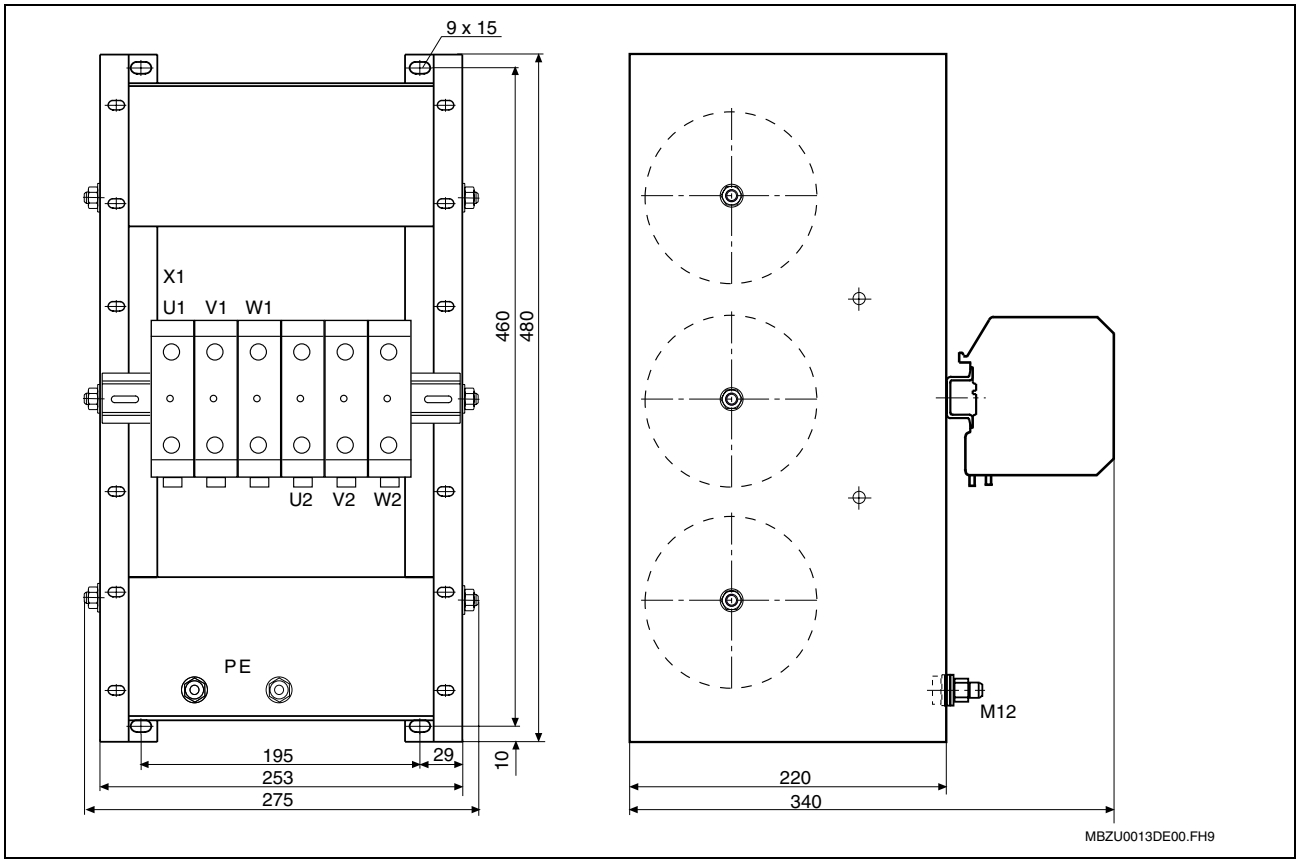
Dimension in mm

Fig.: 7-8 Dimension sheet of Sinusoidal filters 066 / 080



Dimension in mm

Fig.: 7-9 Dimension sheet for Sinusoidal filters 130 / 135



Dimension in mm

Fig.: 7-10 Dimension sheet for Sinusoidal filter 195

7.3 Connection

Example Connection

U1, V1, W1: input of Sinusoidal filter
U2, V2, W2: output of Sinusoidal filter

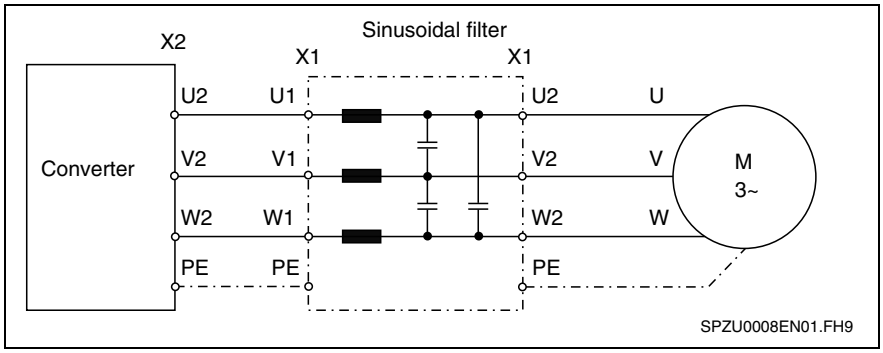


Fig.: 7-11 Connection circuit diagram for Sinusoidal filter

Notes Regarding Layout

The output filter can be operated only with a pulse frequency of f_p = 8 kHz or higher.

Generally, the given nominal current of the output filter may not be exceeded.

The voltage reduction caused by the output filter depends on the load current, on its cosφ and on f_u.

Connection voltage 400V: ΔU at I_{nom} < 10 V (typical)

Connection voltage 500V: ΔU at I_{nom} < 15 V (typical)

8 RZW01.1 Braking Resistor

8.1 Description of Braking Resistor

An external standard braking resistor RZW01.1 is available for converters of the RD 500 device series up to the 110 kW power class. The converter monitors the external standard braking resistor by letting the firmware calculate a thermal portrayal with the current braking power. When the limit values for the thermal portrayal is exceeded, the converter shuts down with error “BR overload” to protect the standard braking resistor from being overloaded.

Technical Characteristics of the Power Resistors

The resistors of the standard braking units consist of a heavy-duty metal alloy. The resistive element is imbedded in an insulating ceramic material with an excellent thermal conductivity in an aluminum housing. The complete encapsulation provides protection from harmful ambient effects and accidental contact with the live parts. The power resistors have the following characteristics:

- compact design and low weight
- high power and impulse load
- robust design and high reliability
- high breakdown resistance
- the resistive element is not flammable

Type Key

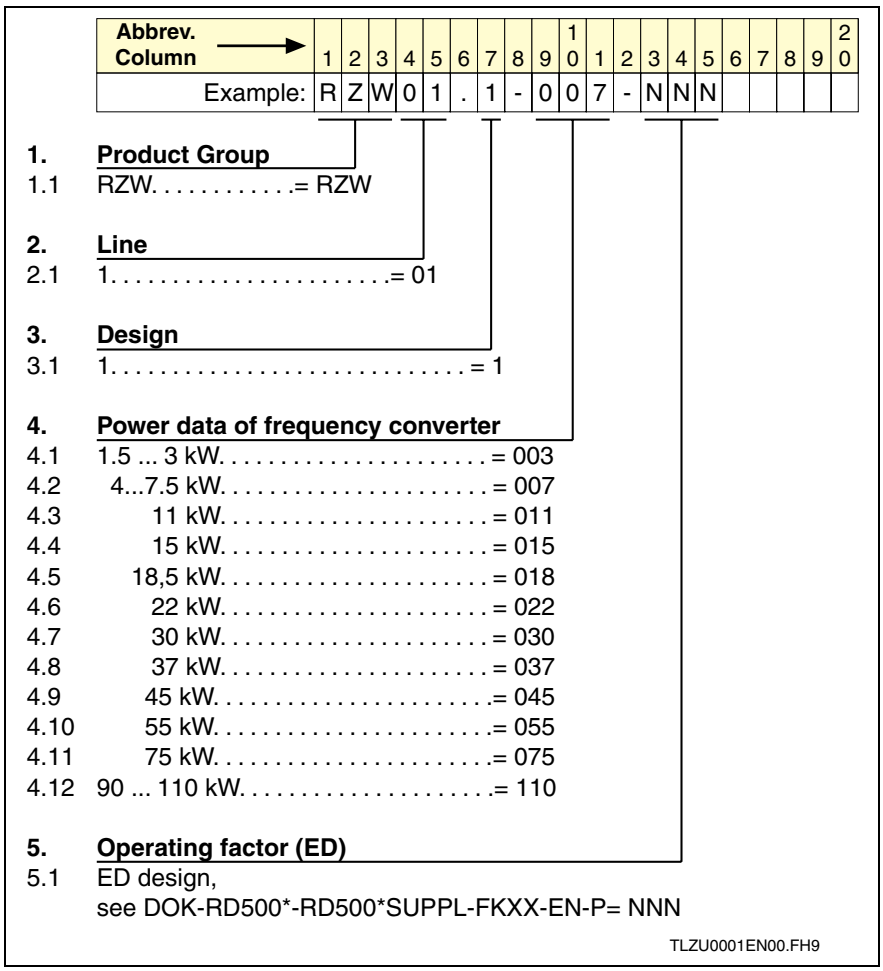


Fig.: 8-1 Type key of braking resistor RZW01.1

Note: Due to the terminal size in size class E, the connection terminals in the connection area do NOT provide protection against direct contact and are not IP20.

This means only IP10 in the area of the connection terminals.

The assignment of the converter to the standard braking resistor in the table absolutely must be maintained because the corresponding power data of the braking resistors are stored in the converters so that the thermal portrayal may be calculated.

Technical Data

Converter	Standard braking resistor RZW01.1						
Power class	**Size class**	**Resis-tance R_{BW}, Ω**	**Nominal power P_D, kW**	**Peak power P_{max} 1), kW**	**Therm. time constant T_{BW}, s**	**Line cross-section, mm^2**	**Weight, kg**
1.5	A	60	0.06	10	185	1.5	1.5
3.0							
4.0	A	35	0.1	18	185	1.5	1.5
5.5							
7.5							
011	B	20	0.18	32	185	2.5	2.3
015 / 018	B	17.5	0.2	37	185	2.5	2.3
022	C	11.7	0.3	56	185	10	3.4
030	C	8.8	0.4	74	185	10	4.2
037	C	7.0	0.5	93	185		4.8
045	C	5.8	0.6	111	185	10	5.6
055 2)	D	5.0	0.7	130	185	10	7.1
075 3)	D	4.4	0.8	148	185	10	7.9
110	E	2.5	1.4	260	185	35	15

1): Peak power for maximum of 1 sec.
2): The braking resistor consists of 037 and 015
3): The braking resistor consists of 045 and 015

Tab.: 8-1 Technical data

Note: The augmented braking resistors in chapters (RZW02.1) and (RZW03.1) are available for frequency converters with a power class of 132 KW to 400 kW. Heat exchangers with a built-in braking resistor are described in chapter (RZK01.1).

Connection

Connect terminal C of the braking resistor with terminal X1.C of the converter. Connect terminal F of the braking resistor with terminal X1.F of the converter. The grounded conductors are to be connected with a line cross-section of at least 10 mm^2 Cu.

Braking resistors 055 and 075 consist of two resistors each of size classes B and C. Connect terminals C and F of both resistors with the cable set supplied.

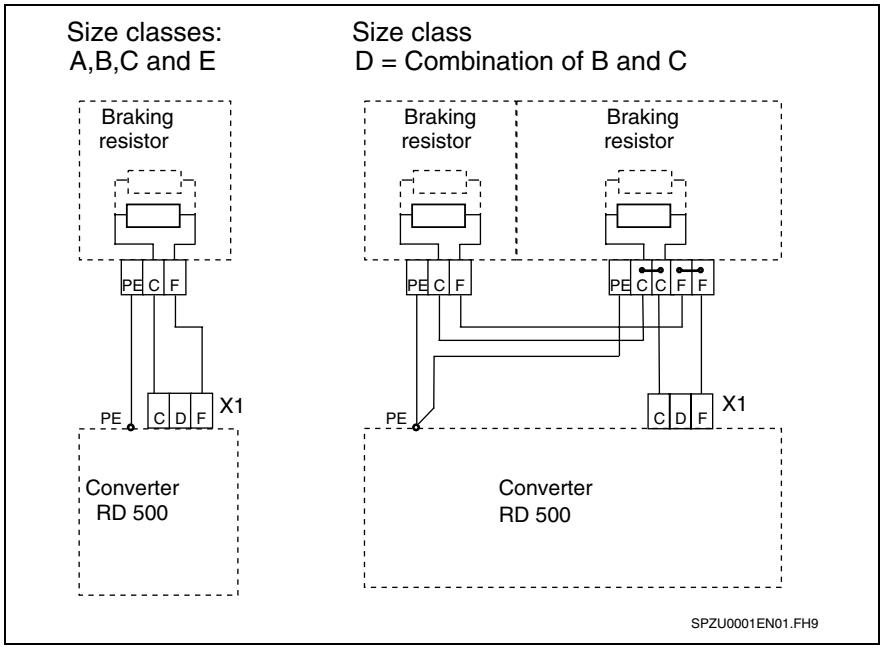


Fig.: 8-2 Connection circuit diagram of braking resistors

Power Rating Limit

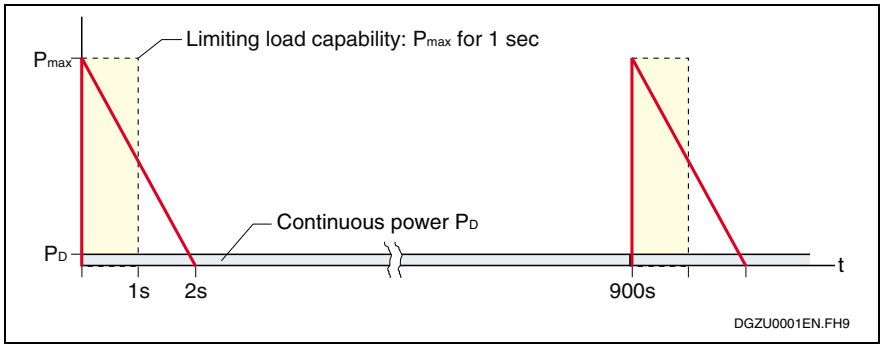


Fig.: 8-3 Power rating limit of braking resistors

In many applications, the power rating limit of the resistors is not attained. Since the theoretical braking and pause times do not change linearly in this case, a precise rating calculation is recommended. See Fig.: 8-9

Type Label

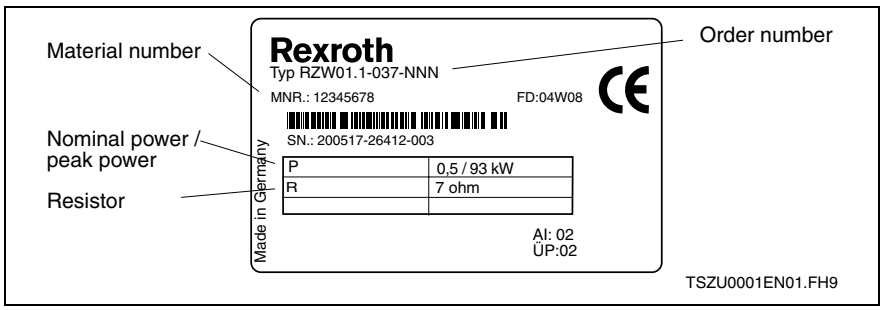


Fig.: 8-4 Type label, RZW01.1

8.2 Operation

Warning

WARNING

Burns due to hot components with temperatures above 30 °C!

⇒ During operation, the braking resistance increases according to the braking power. This can heat the surface of the housing up to 80 °C.

⇒ Personnel that work on the open switch cabinet or in the switching space must note that the braking resistors are exposed.

Settings on Converter

Before the braking resistor is commissioned, it must be checked whether parameter P0036 is set to “Standard” (factory setting). The converter then monitors the external standard braking resistor by calculating a thermal portrayal during operation with the internally stored power data of the braking resistor.

Parameter number	Parameter name	Parameter value
P0036	Braking resistance	Standard

Tab.: 8-2 Affected parameters

Calculation of Load

Depending on the relationship of the average braking power P_{Bm} to the continuous power P_D of the braking resistor, the maximum permitted braking time t_{Bmax} and the braking time t_P that may be required can be determined using the load diagram Fig.: 8-9. At a peak power P_B, the average braking power P_{Bm} is defined as follows:

For Braking Procedures when Stopping and Reversing

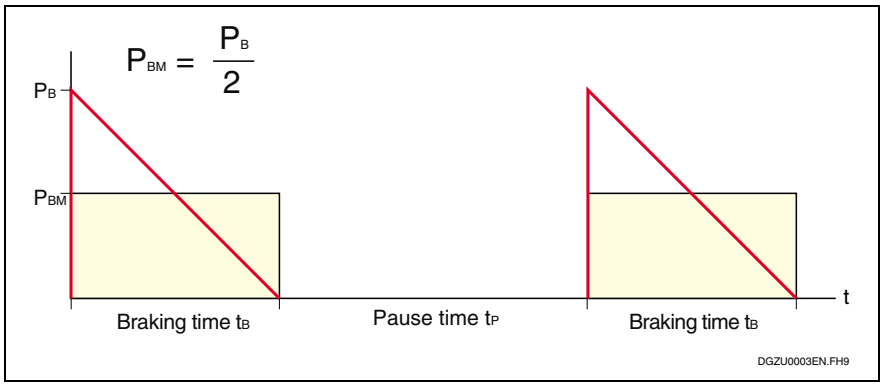


Fig.: 8-5 Load diagram for stopping and reversing

The energy required for stopping is determined by the technological arrangement.

Therefore, the required braking power is affected by the selected braking time.

Decreasing the braking time increases the braking power while increasing the braking time decreases the braking power.

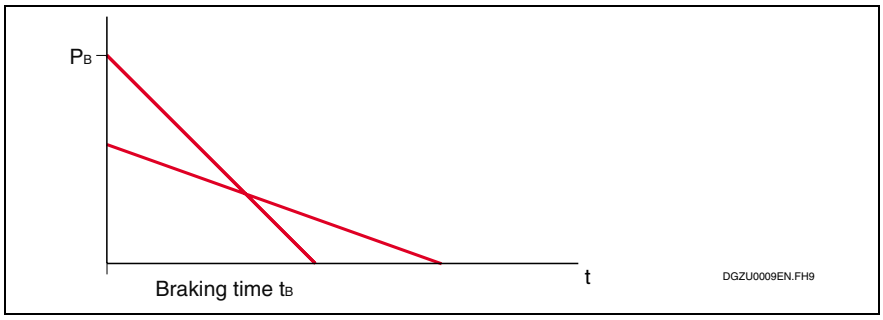


Fig.: 8-6 Effect of braking time on braking power

For Dynamic Operation at Constant Speed

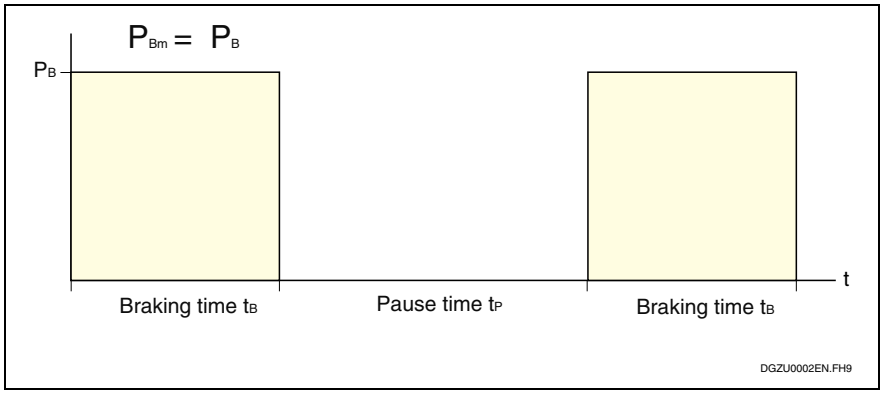


Fig.: 8-7 Load diagram for dynamic operation

Load Diagram

The load diagram is used to determine the permitted braking times and required pause times depending on the relationship of the average braking power P_{BM} to the continuous power P_D of the utilized braking resistor that was calculated above.

Determining the Maximum Permitted Braking Time t_{Bmax}

The thermal time constant of the REFU standard resistors are indicated as a characteristic curve up to power class 110 in diagram 1 above. Using the relationship of the average braking power P_{Bm} to the continuous power P_D of the utilized resistor, you go to the right from the y-axis to the characteristic curve, then read the value for the maximum braking time t_{Bmax} below the intersection on the x-axis.

Determining the Required Pause Time t_P

A family of characteristic curves is indicated for various P_{Bm} / P_D relationships in diagram 2 below. Using the braking time that is actually used, you go to the P_{Bm} / P_D characteristic curve and then read the required pause time t_P from the y-axis.

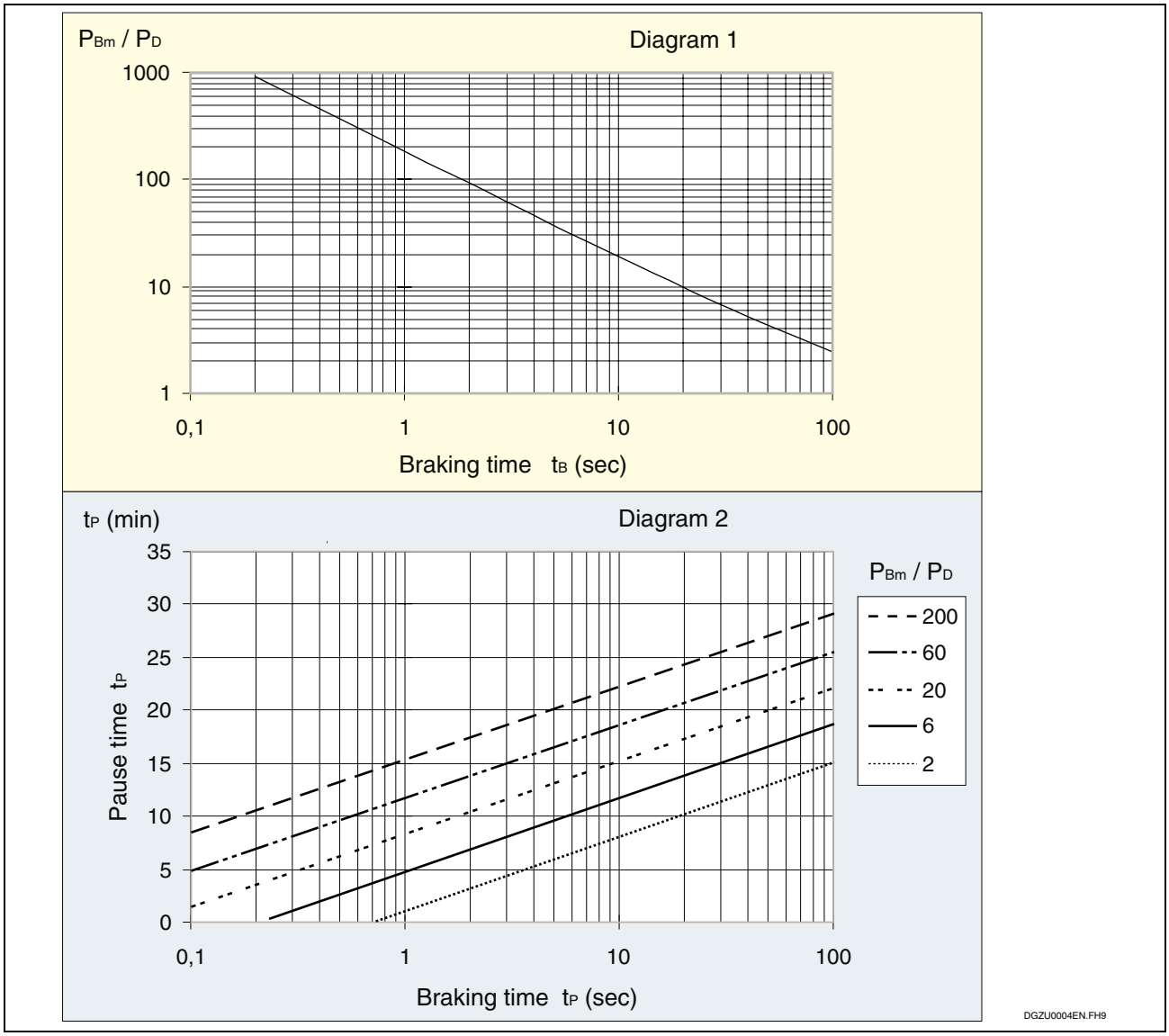


Fig.: 8-8 Load diagram for braking resistors up to a power class of 110 kW

Sample Calculation

Using braking resistor RZW01.1-011:

P_{max} = 32 kW

P_D = 0.18 kW

1. Stopping from nominal speed

Assumption: A peak power P_B of 9.5 kW is required to stop in 2 s.

Calculation: The average braking power is:

$P_{Bm} = P_B / 2 = 9.5 \text{ kW} / 2 = 4.75 \text{ kW}$

The relationship of the average braking power to the continuous power is: $P_{Bm} / P_D = 4.75 \text{ KW} / 0.18 \text{ kW} = 26$

Using this value, the maximum possible braking time t_{Bmax} = 6.5 sec is taken from diagram 1. The condition for the desired braking time is met.

Using the actual braking time of 2 sec, you now go to the theoretical P_{Bm} / P_D = 26 characteristic curve in diagram 2 and then read the required pause time t_P = 11 min from the y-axis. Utilizing the maximum braking time of 6.5 sec would require a pause time of 15 min.

2. Dynamic operation at constant speed

Calculation: The average braking power is: $P_{Bm} = P_B = 9.5 \text{ kW}$

The relationship of the average braking power to the continuous power is: $P_{Bm} / P_D = 9.5 \text{ KW} / 0.18 \text{ kW} = 53$

Using this value, the maximum possible braking time t_{Bmax} = 3.2 sec is taken from diagram 1. The required pause time t_P = 15 min results from diagram 2.

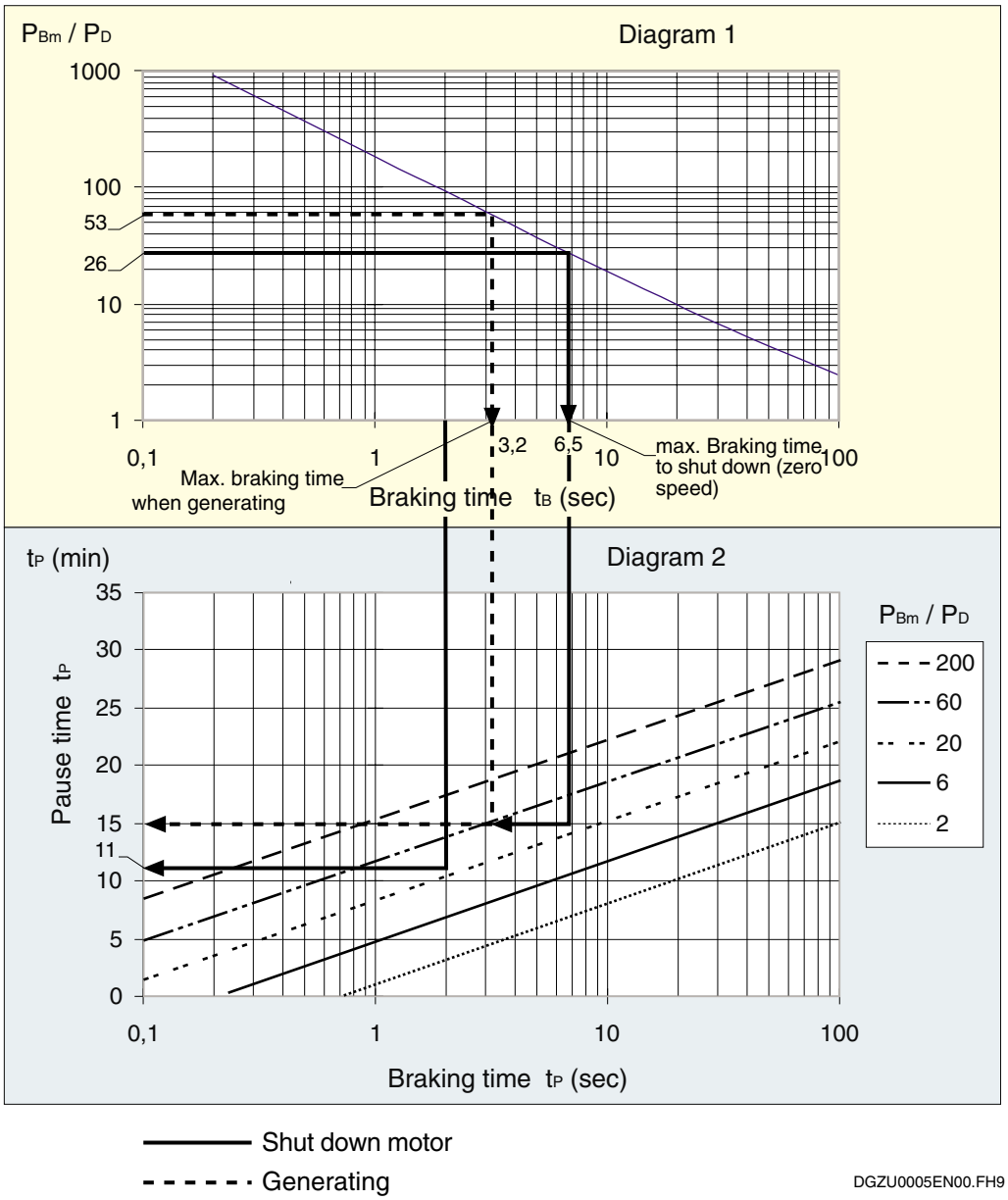


Fig.: 8-9 Sample calculation with load diagram for braking resistor

Malfunction During Braking Operation

When the limit values for the thermal portrayal of the standard braking resistors is exceeded, the converter shuts down with error “BR overload” to protect the braking resistor from being overloaded.

Possible cause of error	Remedy
P0036 is set to “Standard” although no braking resistor is connected.	Switch P0036 to “off”.
Incorrect braking resistor connected.	Check whether the correct braking resistor is connected; see the Technical Data in section 8.1.
Descending ramp too fast	Set a longer descent time.
The resistance is too high due to a defect.	Check the resistance with a suitable measuring instrument; see the Technical Data in section 8.1.
Incorrect relationship of braking and pause times.	To determine the braking and pause times, use the load calculation in section 8.1.

Tab.: 8-3 Causes of errors

8.3 Mechanical Assembly

Storage and Setup Location

Storage

The devices must be stored in clean, dry spaces. The storage temperature may be between –25 °C and +70 °C.

Minimum requirements for the setup location

- The operating area should be dust-free. Air containing dust must be filtered.
- The ambient temperature must range between 0 and 40° C.
- The relative humidity must not exceed 90 % (noncondensing).
- The supplied air must not contain any aggressive or electrically conducting gases that may endanger functioning of the device.
- The air current must not be impeded. The minimum free spaces specified for the supply air and exhaust air for each size class must not be restricted by auxiliary add-ons.
- The device causes power loss and heats the surroundings. Therefore, a sufficient spacing from heat-sensitive devices must be ensured.

Assembling the Braking Resistors

The braking resistors have the same width as converter size classes A to E. They have a constructional grid of 22.5 mm. If fixing rails with threaded holes are used in the constructional grid, several devices can be mounted next to each other without intervening spaces.

Note: The design and nominal power of the braking resistors require that they be cooled in the exhaust air of the converter.

The resistors must not be operated without cooling in the air current.

WARNING

Burns due to hot components with temperatures above 30 °C!

If the braking resistors are assembled as prescribed, the tin housing can heat up to +100 °C at the maximum ambient temperature and at a continuous load. Thermal loading of the surroundings due to radiation and hot exhaust air must be taken into account, especially in the case of cabinet assembly.

Take the following points into account during assembly:

- Assembly must be carried out perpendicular to a level construction area.
- The braking resistors must be mounted directly above the converter (with air cooling) so that they are cooled by the exhaust air of the converter.
- Heat-sensitive parts and electrical equipment such as cable ducts, lines, contactors, etc. may not be mounted in the hot exhaust air current above the braking resistors.
- To ensure that the cooling air can flow without impedance, a space with a height of at least 100 mm must be maintained above the braking resistors.
- In the case of cabinet assembly, the cooling air requirements of the installed devices (see Technical Data, 8.1) must be calculated and the cabinet ventilation must be sized accordingly.

- The fastening screws are shown in the drilling templates of the dimension drawings.

Sample Assembly

Each illustration below shows one converter of size class A, B, C, D or E with the associated braking resistors.

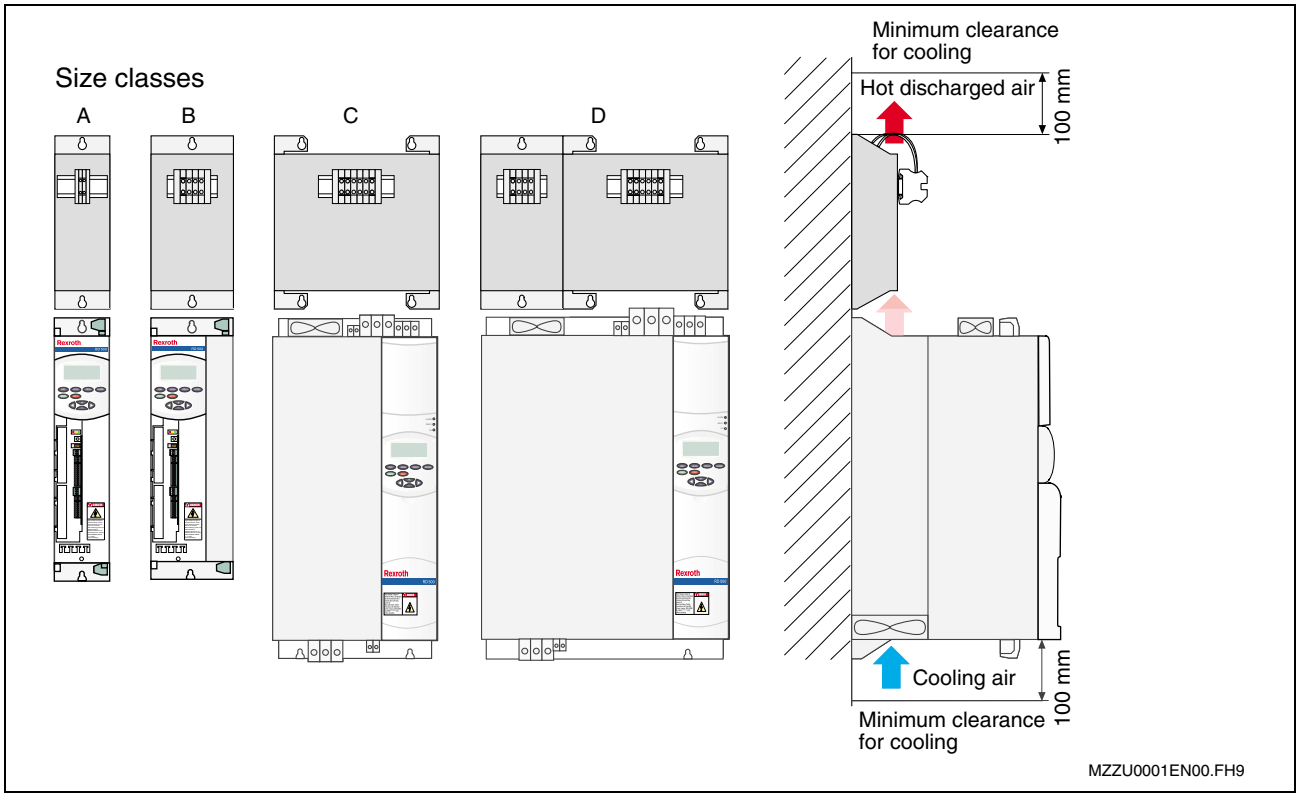


Fig.: 8-10 Sample assembly for braking resistors A - D

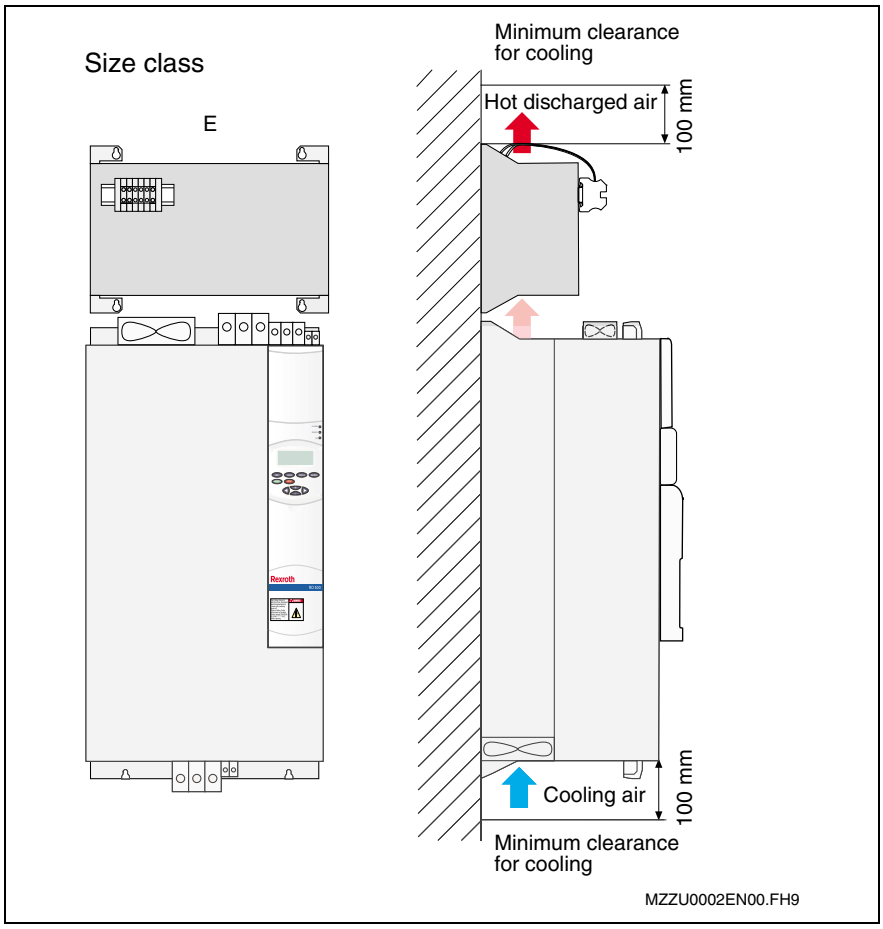


Fig.: 8-11 Sample assembly for braking resistor E

Dimension Drawings

The braking unit of size class D is a combination of braking units of size classes B and C.

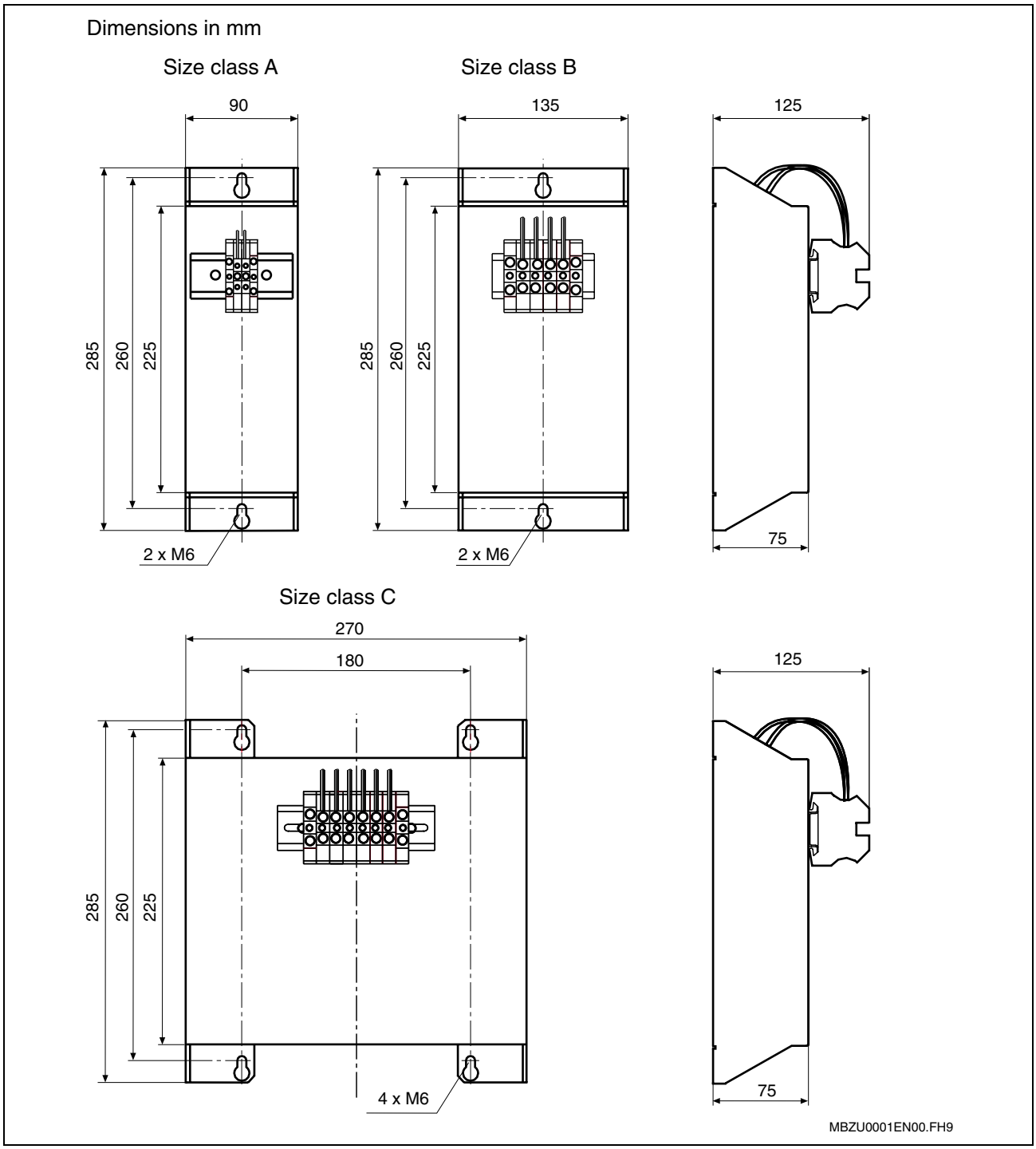


Fig.: 8-12 Dimension sheet for braking resistors A - D

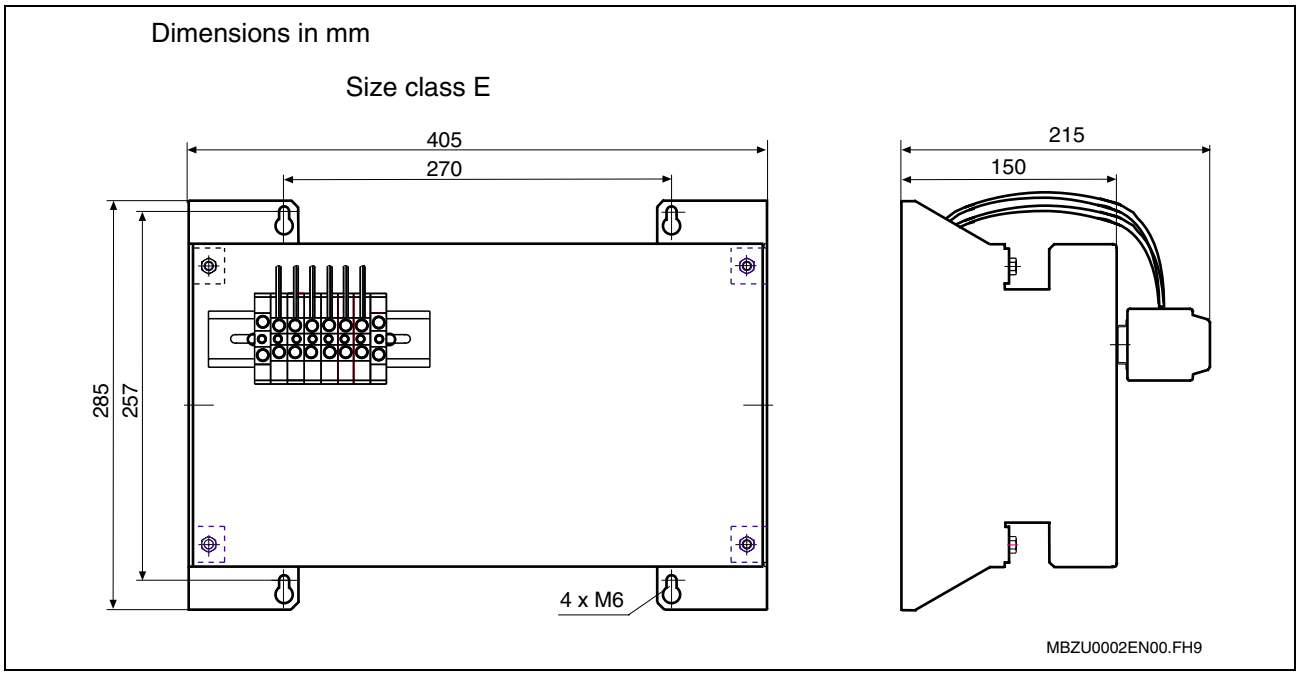


Fig.: 8-13 Dimension sheet for braking resistor E

8.4 Electrical Installation

Assembly of Drives According to EMC

The fundamentals of the assembly of drives according to EMC must be heeded; see the 10 rules for “Assembly of Drives According to EMC. The metal housing of the braking resistor must be connected smoothly and well-conductingly with the switch cabinet or the assembly plate. If necessary, use contact or scraper discs.

8.5 10 Rules for Installation of Drives According to EMC

The following 10 rules are the basics for designing drive systems in compliance with EMC.

Rules 1 to 7 are generally valid. Rules 8 to 10 are especially important to limit noise emission.

Rule 1 All metal parts of the switch cabinet should be connected with one another through the largest possible surface area so that the best electrical connection is established (no paint on paint!). If necessary, use contact or scraper discs. The cabinet door should be connected to the cabinet using the shortest possible grounding straps.

Rule 2 Signal, line supply, motor and power cables should be routed away from another (this eliminates mutual interference!). The minimum clearance is 20 cm. Barriers should be provided between power and signal cables. These barriers should be grounded at several locations.

Rule 3 Contactors, relays, solenoid valves, electromechanical operating hour counters etc. in the cabinet must be provided with noise suppression devices, e.g. using RC elements, diodes, varistors. These devices must be connected directly at the coil.

Rule 4 Non-shielded cables belonging to the same circuit (feeder and return cables) should be twisted with the smallest possible distance between them. Wires which are not used must be grounded at both ends.

Rule 5 Generally, noise which is coupled in can be reduced by routing cables as closely as possible to grounded steel panels. For this reason, cables and wires should not be routed freely in the cabinet, but as closely as possible to the cabinet itself and the mounting panels. This is also true for reserve cables.

Rule 6 Incremental encoders must be connected using shielded cables. The shield must be connected at the incremental encoder and at the AC drive converter through the largest possible surface area. The shield may not be interrupted, e.g. using intermediate terminals.

Rule 7 The shields of signal cables must be connected to ground at both ends through the largest possible surface area to establish a good electrical connection (transmitter and receiver). If the potential bonding between the screen connections is poor, an additional potential bonding conductor with a cross-section of at least 10 mm² (AWG 6) should be connected in parallel with the shield to reduce the shield current. The shields can be connected to ground at several locations, e.g. on the cabinet housing and on cable trays. Foil shields are not recommended. Braided screens provide a better shielding effect (factor of 5).

If the potential bonding is poor, analog signal cables may only be grounded to the converter at one end in order to prevent low-frequency noise being radiated into the screen (50 Hz).

Rule 8 Always place a radio interference suppression filter close to the noise source. The filter is to be connected flush with the cabinet housing, mounting plate, etc. The best solution is a bare metal mounting panel

(e.g. stainless steel, galvanized steel), because the complete mounting surface can be used to establish good electrical contact.

The incoming and outgoing cables of the radio interference suppression filter should be separated.

Rule 9 All variable-speed motors should be connected using shielded cables, whereby the shield is connected at both ends to the housings through the largest possible surface area to minimize the inductance. The motor feeder cables should also be shielded outside the cabinet, or at least screened using barriers.

Cables with steel shields are not suitable.

To connect the shield at the motor, a suitable PG gland with shield connection can be used (e.g. “SKINDICHT SHV/SRE/E” from the Lapp Company, Stuttgart). It should be ensured that the connection between the motor terminal box and the motor housing has a low impedance. Otherwise, use an additional grounding strap between them. **Never use plastic motor terminal boxes!**

Rule 10 The shield between the motor and the frequency converter may not be interrupted by installing components such as output reactors, sinusoidal filters, motor filters, fuses, contactors, etc. The components must be mounted on mounting panels which also simultaneously serve as the shield connection for the incoming and outgoing motor cables. Metal barriers may be required to shield the components.

Warnings and Notes

DANGER

Death by electrocution possible due to live parts with more than 50 V!

⇒ The RD 500 devices are operated at high voltages. All work must be carried out when they are not under power!

⇒ All work must be carried out only by qualified personnel!

⇒ Not heeding these warnings may result in death, serious injuries or significant damages to materials.

⇒ Due to the intermediate circuit capacitors, the device is still under a dangerous voltage up to 30 minutes after power has been switched off. Therefore, work on the device or on the intermediate circuit terminals is permitted only after a corresponding waiting time.

⇒ The power and control terminals may be live even if the motor is at a standstill

⇒ In the case of a central supply of the intermediate circuit voltage, ensure that the inverter is safely separated from the intermediate circuit voltage!

⇒ When working on an open device, note that live parts are exposed.

⇒ The user is responsible for ensuring that all devices are set up and connected according to the recognized technical regulations in the country of use as well as other regionally valid regulations. Cable dimensioning, fuse protection, grounding, switching off, separation and protection from excess currents must be especially taken into account.

9 RZW02.1 Braking Resistors Augmented IP20

9.1 Description of Augmented Braking Resistor

For dynamic braking with increased power, such as that needed when driving with large inertia masses (i.e. centrifuges), long braking procedures (i.e. for crane lifting gear), augmented braking resistors are to be connected to the converters with integrated brake choppers (device types B and F). The augmented braking resistors can also be protected from overloads using the monitoring function in the firmware of the RD 500.

Technical Characteristics

Protection class IP 20

- Type A

Cemented, wire-wound pipe fixed resistor in a bolted-on state with lateral parts and a perforated cover, attachment parallel to the assembly surface, with two connections wired to porcelain terminals in an attached terminal box with PG screws.

- Types B and C

Fixed resistor with steel screen design. Depending on power, with 2 screw terminals, 2 M6 or M8 stud terminals; housing as for type A.

- Type D

Fixed resistor with steel screen design in galvanized steel housing, with external ventilation using built-in 3 AC / 400 V / 50 Hz / 3.5 kVA axial ventilator, air current monitoring using wind vane relay guided to terminals.

Layout

The resistor devices are tuned to the maximum motor power that can be connected to the converter. The specified braking power is valid for the given relative switch-on durations (SD) of 6 %, 15 %, 25 %, 40 %, and 60 %.
The relative switch-on duration is based on a load cycle of 120 s.

$$t_{off} = \frac{t_{on}}{t_{on\max}} \times t_{off}$$

Example: At 40 % SD, the resistor may be switched on without interruptions for a maximum of 48 s (t_{onmax}) and must then be switched off for 72 s. Naturally, shorter switch-on times are also permitted. The required shutdown duration decreases at the same proportion. For example, a switch-on time of 10 s results in a shutdown duration of

$$Example: \frac{10s}{48s} \times 72s = 15s$$

The continuous power of the corresponding resistor type can be calculated using the reduction factors given in the following tables. The braking power at the corresponding switch-on duration is to be divided by the reduction factor.

Example: Resistor type A 3;

P_{peak} = 2.7 kW at 25% SD, reduction factor = $P_{peak:}$ $P_{continuous}$ = 3.2

$P_{continuous}$ = 2.7 kW: 3.2 = 0.844 kW.

Switch-on cycles

SD	P_{peak}: $P_{contin.}$	t_{onmax}, s	t_{offmax}, s
60 %	1.5	72	48
40 %	2.2	48	72
25 %	3.2	30	90
15 %	4	18	102
6 %	8	7.2	112.8

Tab.: 9-1 Switch-on cycles

Thermal time constant

Braking resistor type	Thermal time constant TBW, s
Pipe resistor type A	300
Steel screen resistor types B, C, D	100

Tab.: 9-2 Thermal time constant TBW

Type Key

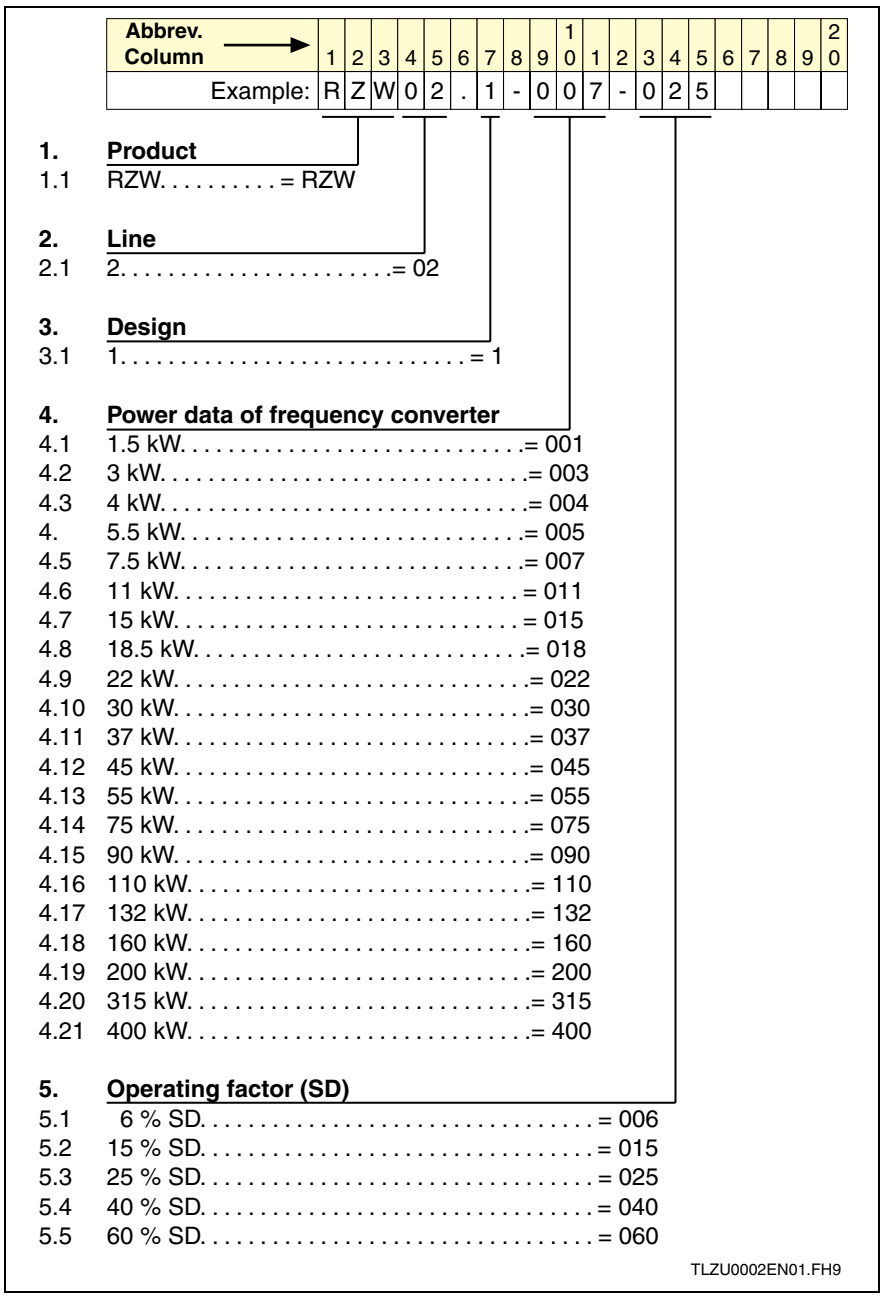


Fig.: 9-1 Type key for augmented braking resistors IP20

Technical Data

Table for SD 6 %, 15 %, 25 %

Power class	Min. connectable resistance value, Ω	Peak power[1] kW	SD 6 %			SD 15 %			SD 25 %		
			Type	Cross-section, mm²	Resistance, Ω	Type	Cross-section, mm²	Resistance, Ω	Type	Cross-section, mm²	Resistance, Ω
001	30	1.3	A11	2.5	120	A12	2.5	120	A1	2.5	120
003	30	2.7	A12	2.5	68	A2	2.5	68	A3	2.5	68
004	30	3.5	A1	2.5	47	A21	2.5	47	A4	2.5	47
005	30	5	A2	2.5	47	A3	2.5	47	A7	2.5	47
007	30	6.5	A2	2.5	33	A5	2.5	33	B1	2.5	33
011	20	10	A3	2.5	22	A6	2.5	22	B1	4	23
015 / 018	17.5	13.5	A5	2.5	18	B1	4	19	B2	6	18
022	11.6	20	A6	2.5	15	B2	6	15	B3	10	14
030	8.75	27	B1	6	10	B2	10	9.5	B3	16	10
037	7	33	B1	10	7.4	B3	16	8.0	B3	25	7.3
045	6	40	B2	16	7.5	B3	25	6.6	B4	25	7.3
055	5	50	B2	16	6.1	B4	35	5.5	B5	35	5.1
075	3.75	67	B3	25	4.9	B4	50	5.1	C2	50	5.4
090	2.5	81	B3	50	3.1	B5	50	3.3	C3	50	3.7
110	2.5	100	C11	50	3.1	C3	70	2.8	C5	70	2.6
132 [2]	2.2	119	C11	50	2.5	C3	70	2.7	C4	70	2.4
160 [2]	2.2	144	C12	50	2.6	C4	70	2.7	C6	70	2.4
200 [2]	1.6	180	C2*	70	1.8	C6	95	1.8	C7	95	1.8
315 [2]	2 x 2.2	280	C4*	50	2 x 2.6	2 x C5	70	2.6 each	2 x C6	70	2.4 each
400 [2]	2 x 1.6	360	C6*	70	2 x 1.8	2 x C6	95	1.8 each	2 x C7	95	1.8 each

1): for SD provided
2): Order converter with auxiliary function W1, augmented BR connection

Tab.: 9-3 Technical data for SD 6 %, 15 %, 25 %

Note: If 2 resistors are specified for one position (2 x), these are to be switched parallel up to converter power code 200. Converters with power codes 315 and 400 have two brake choppers each. Depending on the power, the braking resistors are distributed either in one housing in two separate groups or in two housings. In each case, the two resistors are connected to the converter with separate lines.

Table for SD 40 %, 60 %

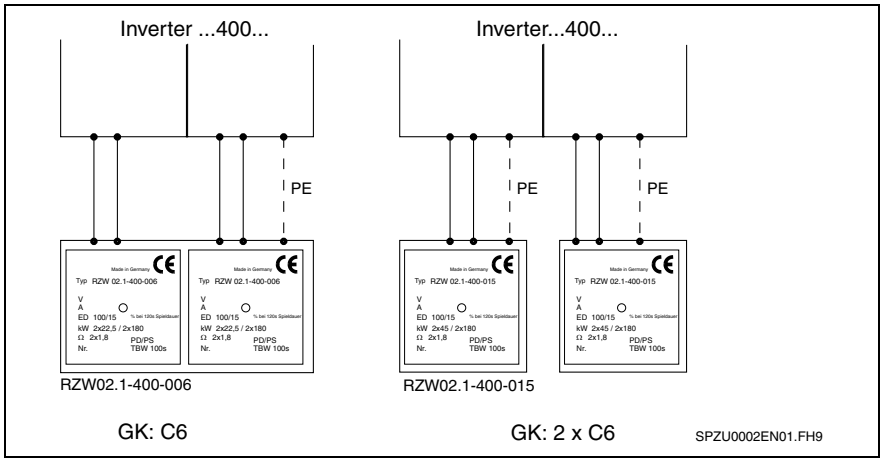
Power class	Min. connectable resistance value, Ω	Peak power[1] kW	SD 40 %			SD 60 %		
			Type	Cross-section, mm²	Resistance, Ω	Type	Cross-section, mm²	Resistance, Ω
001	30	1.3	A2	2.5	120	A3	2.5	120
003	30	2.7	A12	2.5	68	A2	2.5	68
004	30	3.5	A5	2.5	47	A8	2.5	47
005	30	5	A8	2.5	47	B2	2.5	42
007	30	6.5	B1	2.5	33	B2	2.5	33
011	20	10	B2	4	22	B3	6	23
015 / 018	17,5	13.5	B2	10	18	B3	10	18
018	13.3	16.5	B3	10	15	B4	16	13
022	11.6	20	B3	10	13	B4	16	13
030	8.75	27	B4	16	10	B5	25	11
037	7	33	B4	25	8.1	C3	35	7.2
045	6	40	B5	35	6.7	C3	50	7
055	5	50	C2	50	5.5	C4	50	5.4
075	3.75	67	C3	50	5	C6	70	5.3
090	2.5	81	C4	70	3.7	C7	70	3.9
110	2.5	100	C6	70	2.7	2 x C5 [3]	2 x 50	5.4 each
132 [2]	2.2	119	C7	95	2.3	2 x C6	2 x 50	4.4 each
160 [2]	2.2	144	2 x C3	95	5.4 each	2 x C7	2 x 50	4.8 each
200 [2]	1,6	180	2 x C4	2 x 50	3.7 each	D1 [4]	2 x 70	2.0
315 [2]	2 x 2.2	2 x 140	D1	95	2 x 2.4	D2	2 x 50	2 x 2.7
400 [2]	2 x 1.6	2 x 180	D1	95	2 x 2.1	D2 [5]	2 x 70	2 x 2.0

1): for SD provided
2): Order converter with auxiliary function W1, augmented BR connection
3): $P_{contin.}$ = 55 kW
4): $P_{contin.}$ = 100 kW
5): $P_{contin.}$ = 2 x 100 kW

Tab.: 9-4 Technical data for SD 40 %, 60 %

Note: If 2 resistors are specified for one position (2 x), these are to be switched parallel up to converter power code 200. Converters with power codes 315 and 400 have two brake choppers each. Depending on the power, the braking resistors are distributed either in one housing in two separate groups or in two housings. In each case, the two resistors are connected to the converter with separate lines.

Connection



1) Connecting 2 resistor groups in one housing
2) Connecting resistors in two housings

Fig.: 9-2 Sample connection with separate lines

Line Cross-Section

The cross-section of the grounded conductor must be at least 10 mm² (AWG 10) (if the cable cross-sections of the power lines are >10mm² (AWG 10), the grounded conductor must be at least as large).

Requirements for Line Layout

- The cross-sections apply for one phase each for multiwire conductors and are specified according to VDE0298 regulations.
- Up to 50 mm² (AWG 1/0), single wires in a cable duct
- As of 70 mm² (AWG 2/0), free, contact-free layout on cable tray

Type Label

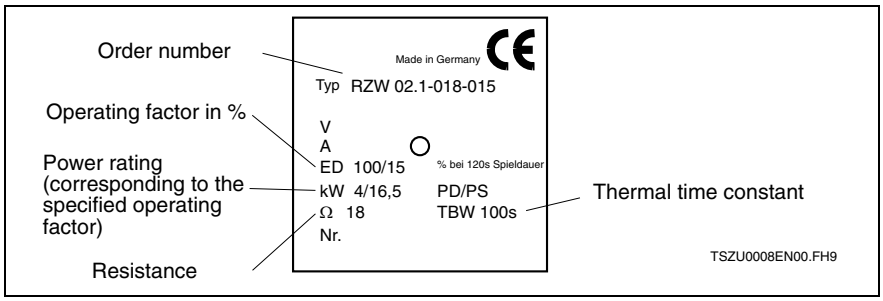


Fig.: 9-3 Type label for RZW02.1

1st example for setting parameters:

Parameter	Parameter name	Parameter value
P0623	Resistance	18.0 Ω
P0624	Power	4.0 kW (value for 100 % SD)
P0625	Thermal time constant	100.0 s

Tab.: 9-5 1st example for setting parameters

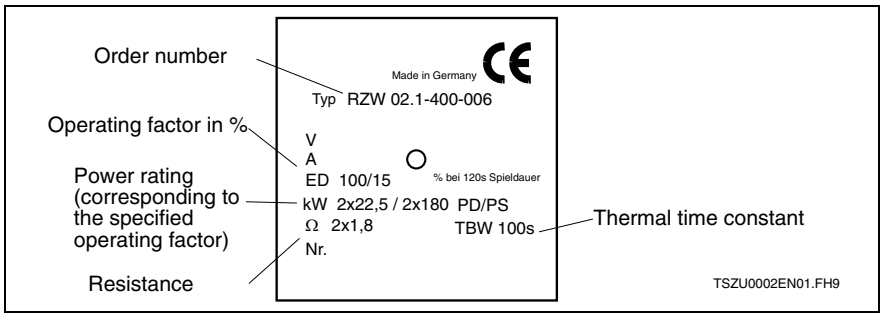


Fig.: 9-4 Type label for RZW02.1-400-006

2nd example for setting parameters:

Parameter	Parameter name	Parameter value
P0623	Resistance	1.8 Ω
P0624	Power	22.5 kW (value for 100 % SD)
P0625	Thermal time constant	100.0 s

Tab.: 9-6 2nd example for setting parameters

Note: If 2 resistors or 2 resistor groups are connected (i.e. in power class 160 kW at 40 % ED or in power classes 315 kW and 400 kW), the values of **one** resistor group / **one** resistor are to be entered in parameters P0623 – P0625.

9.2 Operation

Warning

WARNING

Burns due to hot components with temperatures above 30 °C!

⇒ In operation, the braking resistors heat up according to the braking power. This can heat the surface of the housing up to 80 °C.

⇒ Personnel that work on the open switch cabinet or in the switching space must note that the braking resistors are exposed.

Settings on Converter

Before the braking resistor is commissioned, the following settings must be made on the device to ensure that the braking resistor is monitored with the correct thermal portrayal during operation.

Parameter number	Parameter name	Parameter value
P0623	Resistance value	Can be found on type label; see section **9.1**
P0624	Continuous power of connected resistor	Can be found on type label; see section **9.1**
P0625	Thermal time constant	Can be found on type label; see section **9.1**
P0036	Externally programmable	

Tab.: 9-7 Affected parameters

Malfunction During Braking Operation

When the limit values for the thermal portrayal of the braking resistors is exceeded, the converter shuts down with error “BR overload” to protect the braking resistor from being overloaded.

Possible cause of error	Remedy
P0036	Externally programmable
Incorrect braking resistor connected.	Check whether the correct braking resistor is connected; see Technical Data section 9.1.
Descending ramp too fast	Set a longer descent time.
The resistance is too high due to a defect.	Check the resistance with a suitable measuring instrument; see Technical Data section 9.1.
Parameters P0623 –P0625 set incorrectly	Check the parameter setting

Tab.: 9-8 Causes of errors

9.3 Mechanical Assembly

Storage and Setup Location

Storage

The devices must be stored in clean, dry spaces. The storage temperature may be between –25 °C and +70 °C.

Minimum requirements for the setup location

- The operating area should be dust-free. Air containing dust must be filtered.
- The ambient temperature must range between 0 and 40 °C.
- The relative humidity must not exceed 90 % (noncondensing).
- The supplied air must not contain any aggressive or electrically conducting gases that may endanger functioning of the device.
- The air current must not be impeded. The minimum free spaces specified for the supply air and exhaust air for each size class must not be restricted by auxiliary add-ons.
- The device causes power loss and heats the surroundings. Therefore, a sufficient spacing from heat-sensitive devices must be ensured.

Dimension Drawings

Fixed Resistor, IP 20, Type A

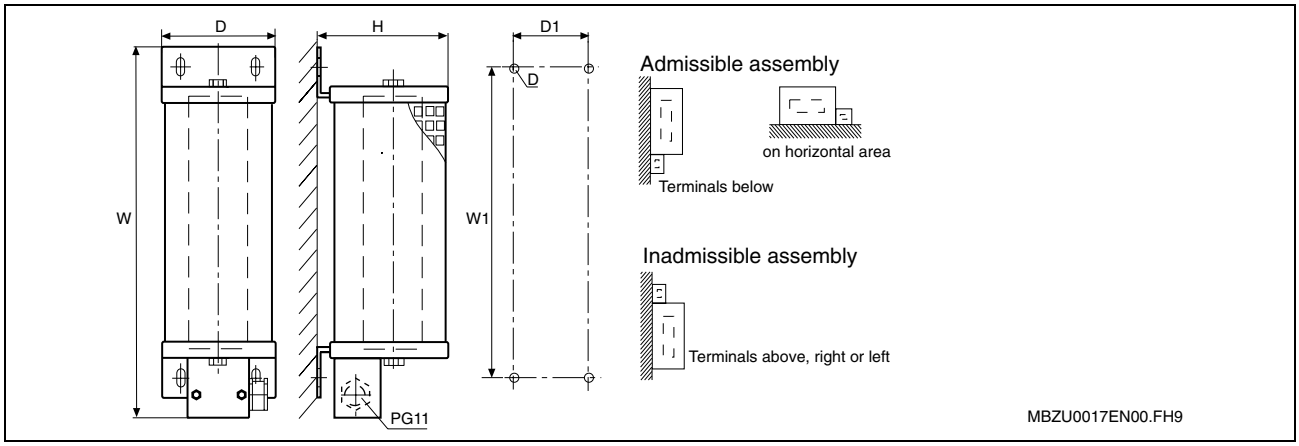


Fig.: 9-5 Types A1 – A3, A11, A12, A21

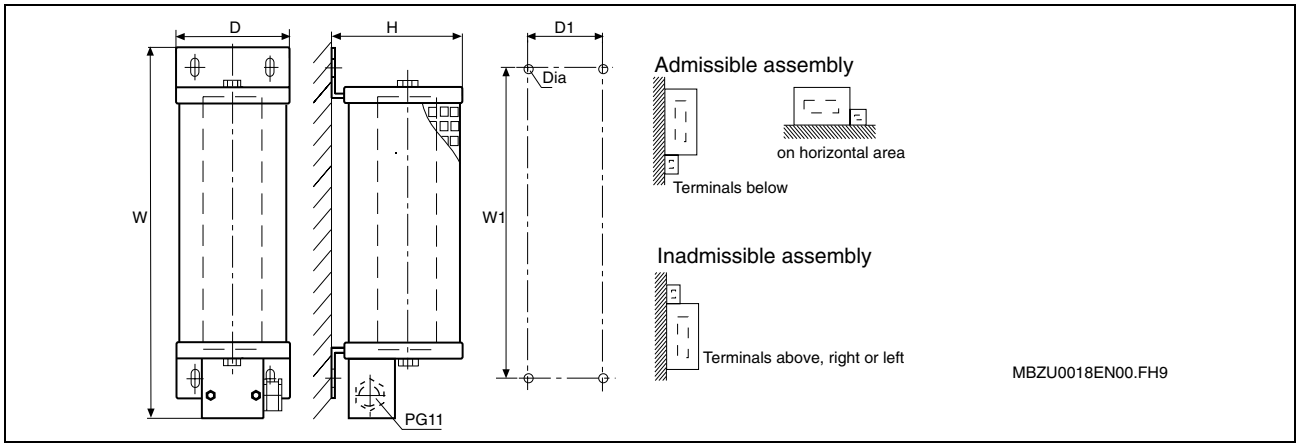


Fig.: 9-6 Types A4 – A6

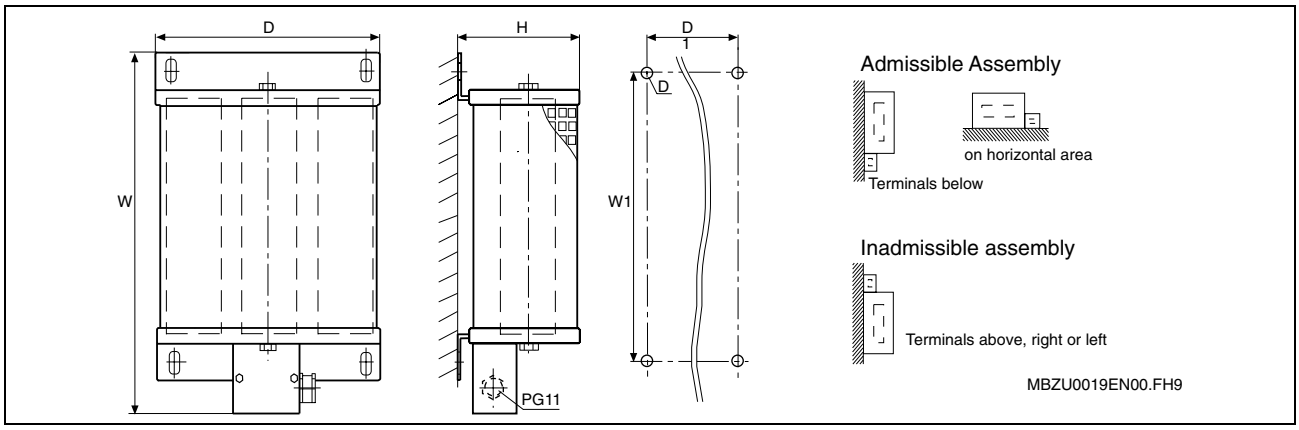


Fig.: 9-7 Types A7 – A9

Type	Dimensions, mm						Weight, kg
	W	D	H	W1	D1	D	
A1	386	92	120	326	64	M6	1.8
A2	486	92	120	426	64	M6	2.3
A3	686	92	120	626	64	M6	3.4
A11	285	66	77	260	44	M4	0.8
A12	389	75	87	360	44	M4	1.2
A21	586	92	120	526	64	M6	2.8
A4	486	185	120	426	150	M6	4.3
A5	586	185	120	526	150	M6	5.2
A6	686	185	120	626	150	M6	6.2
A7	486	275	120	426	240	M6	6.5
A8	586	275	120	526	240	M6	7.5
A9	686	275	120	626	240	M6	8.8

Tab.: 9-9 Table of dimensions for braking resistor type A

Steel Screen Fixed Resistor, IP 20, Type B

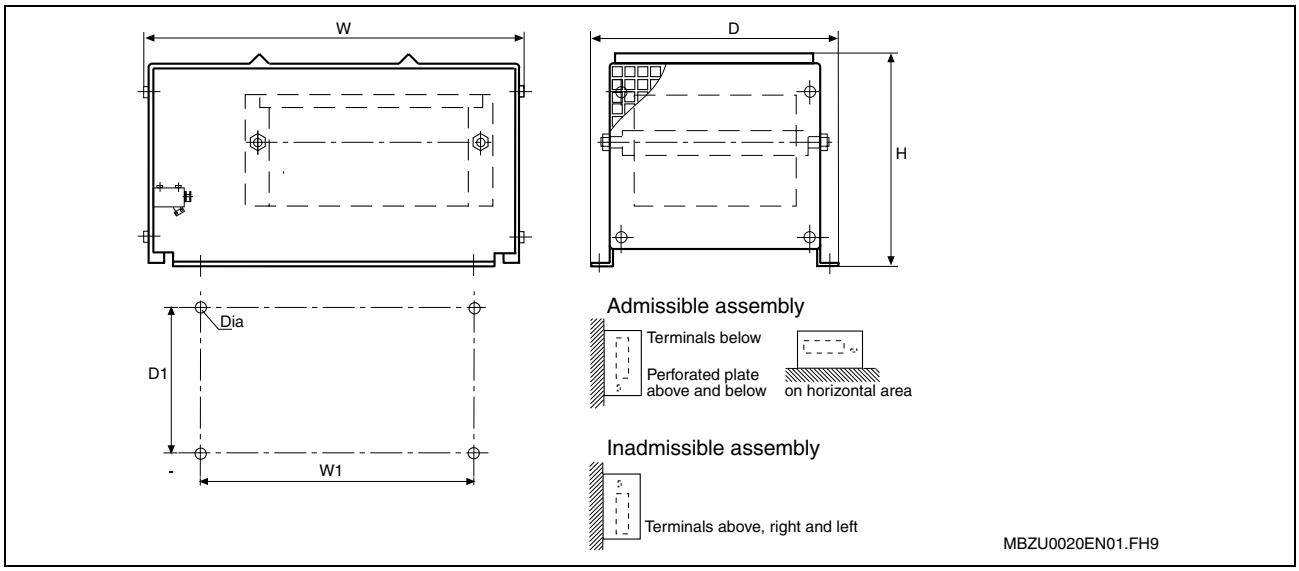


Fig.: 9-8 Types B1 – B5

Type	Dimensions, mm						Weight, kg
	W	D	H	W1	D1	D	
B1	490	300	270	380	270	M10	9.5
B2	490	400	270	380	370	M10	13
B3	490	600	270	380	570	M10	22
B4	490	800	270	380	770	M10	33
B5	490	1000	270	380	970	M10	44

Tab.: 9-10 Table of dimensions for braking resistor type B

Steel Screen Fixed Resistor, IP 20, Type C

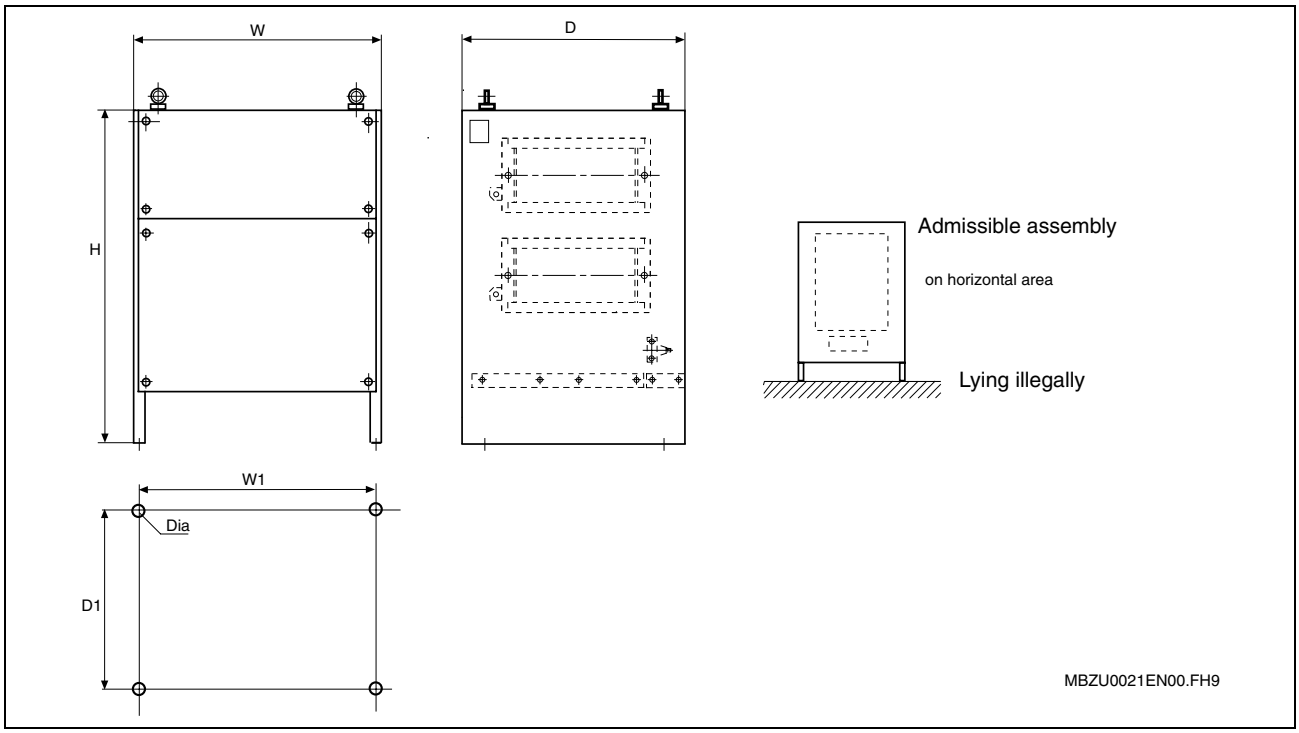


Fig.: 9-9 Types C1 – C7

Type	Dimensions, mm						Weight, kg
	W	D	H	W1	D1	D	
C1	395	490	710	370	380	M10	37
C2	595	490	710	570	380	M10	56
C3	795	490	710	770	380	M10	80
C4	995	490	710	970	380	M10	93
C5	595	490	960	570	380	M10	74
C6	795	490	960	770	380	M10	102
C7	995	490	960	970	380	M10	126
C11	795	490	460	770	380	M10	45
C12	995	490	460	970	380	M10	54

Tab.: 9-11 Table of dimensions for braking resistor type C

Steel Screen Fixed Resistor, IP 20, Type D

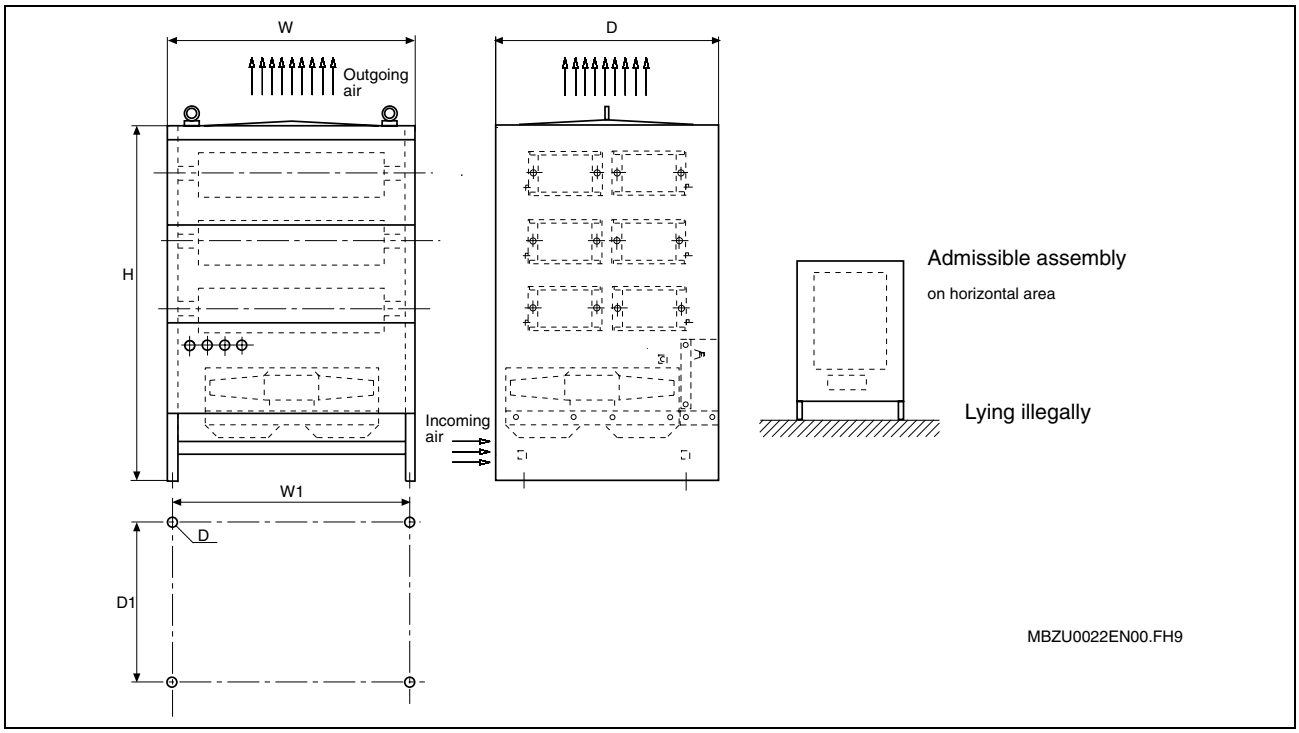


Fig.: 9-10 Types D1 – D2

Type	Dimensions, mm						Weight, kg
	W	D	H	W1	D1	D	
D1	995	955	1435	970	850	M12	265
D2	995	955	1700	970	850	M12	370

Tab.: 9-12 Table of dimensions for braking resistor type D

10 RZW03.1 Braking Resistors Augmented IP23

10.1 Description of Augmented Braking Resistor

For dynamic braking with increased power, such as that needed when driving with large inertia masses (i.e. centrifuges), long braking procedures (i.e. for crane lifting gear), augmented braking resistors are to be connected to the converters with integrated brake choppers (device types B and F). The augmented braking resistors can also be protected from overloads using the monitoring function in the firmware of the RD 500.

Technical Characteristics

Protection class IP 23

- Type E

Wire-wound lamella resistor devices for wall assembly, with 2 terminals and several holes for cable entries that are closed by rubber grommets.

- Type F

Fixed resistor with steel screen design. Depending on power, with 2 screw terminals, 2 M6, M8, M10 or M12 stud terminals.

- Type G

Fixed resistor devices with steel screen design in galvanized steel housing, with external ventilation using built-in 3 AC / 400 V / 50 Hz / 3.5 kVA axial ventilator, air current monitoring using wind vane relay guided to terminals.

The resistors are supplied with a galvanized steel plate housing.

Layout

The resistor devices are tuned to the maximum motor power that can be connected to the converter. The specified braking power is valid for the given relative switch-on durations (SD) of 6 %, 15 %, 25 %, 40 % and 60 %.

The relative switch-on duration is based on a load cycle of 120 s.

$$t_{off} = \frac{t_{on}}{t_{on\max}} \times t_{off}$$

Example: At 40 % SD, the resistor may be switched on without interruptions for a maximum of 48 s (t_{onmax}) and must then be switched off for 72 s. Naturally, shorter switch-on times are also permitted. The required shutdown duration decreases at the same proportion. For example, a switch-on time of 10 s results in a shutdown duration of

$$Example: \frac{10s}{48s} \times 72s = 15s$$

The continuous power of the corresponding resistor type can be calculated using the reduction factors given in the following tables. The braking power at the corresponding switch-on duration is to be divided by the reduction factor.

Example: Resistor type E 3;

P_{peak} = 5.0 kW at 25 % SD, reduction factor = $P_{peak:}$ $P_{continuous}$ = 3.2 kW

$P_{continuous}$ = 5.0 kW: 3.2 = 1.5625 kW.

Switch-on cycles

SD	**P_{peak} : $P_{continuous}$**	**$T_{onmax,}$ s**	**$T_{offmax,}$ s**
60 %	1,5	72	48
40 %	2,2	48	72
25 %	3,2	30	90
15 %	4	18	102
6 %	8	7,2	112,8

Tab.: 10-1 Switch-on cycles

Thermal time constant

Braking resistor type	**Thermal time constant TBW, s**
Lamella resistor type E	150
Steel screen resistor types F and G	100

Tab.: 10-2 Thermal time constant TBW

Type Key

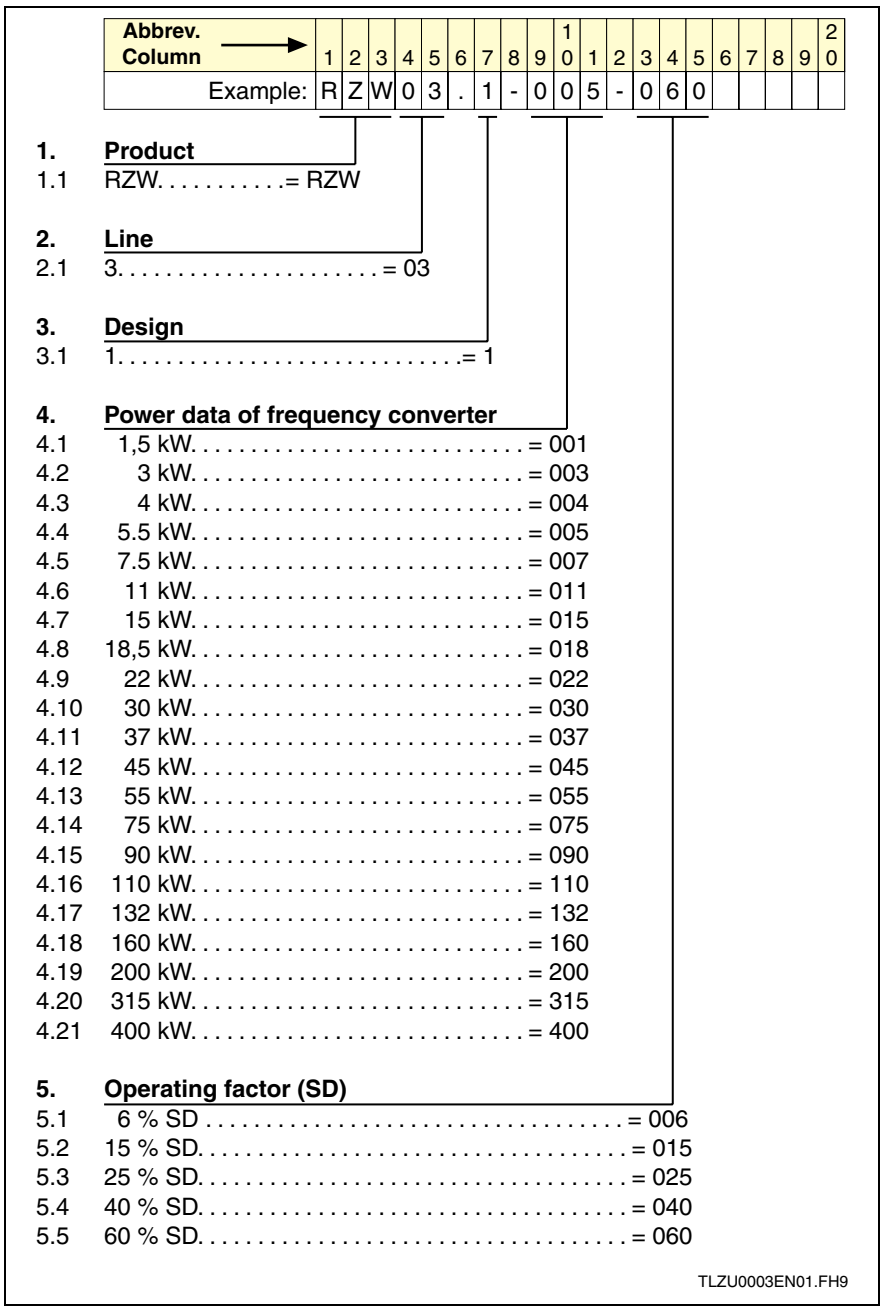


Fig.: 10-1 Type key for augmented braking resistors IP23

Technical Data

Table for SD 6 %, 15 %, 25 %

Power class	Min. connectable resistance value, W	Peak power[1] kW	SD 6 %			SD 15 %			SD 25 %		
			Type	Cross-section, mm²	Resistance, Ω	Type	Cross-section, mm²	Resistance, Ω	Type	Cross-section, mm²	Resistance, Ω
001	30	1.3	E11	2.5	120	E11	2.5	120	E1	2.5	120
003	30	2.7	E11	2.5	68	E1	2.5	68	E2	2.5	68
004	30	3.5	E1	2.5	47	E2	2.5	47	E2	2.5	47
005	30	5	E1	2.5	47	E2	2.5	47	E3	2.5	47
007	30	6.5	E2	2.5	33	E3	2.5	33	F1	2.5	33
011	20	10	E2	2.5	22	E3	2.5	22	F1	4	23
015 / 018	17.5	13.5	E3	2.5	18	F1	4	19	F1	6	18
022	11.6	20	E3	4	12	F1	6	15	F2	10	14
030	8.75	27	F1	6	10	F1	16	9,5	F2	16	10
037	7	33	F1	10	7.4	F2	16	8.0	F2	25	7.3
045	6	40	F1	16	7.5	F2	25	6.6	F3	25	7.3
055	5	50	F1	16	6.1	F3	35	5.5	F4	35	5.1
075	3.75	67	F2	25	4.9	F3	50	5.1	F6	50	5.4
090	2.5	81	F2	50	3.1	F4	50	3.3	F7	50	3.7
110	2.5	100	F3	50	3.1	F7	70	2.8	F9	70	2.6
132 [2]	2.2	119	F3	50	2.5	F7	70	2.7	F8	70	2.4
160 [2]	2.2	144	F4	50	2.6	F8	70	2.7	F10	70	2.4
200 [2]	1.6	180	F6	70	1.8	F10	95	1.8	F11	95	1.8
315 [2]	2 x 2.2	2 x 140	F8	50	2 x 2.6	2 x F9	70	2.6 each	2 x F10	70	2.4 each
400 [2]	2 x 1,6	2 x 180	F10	70	2 x 1.8	2 x F10	95	1.8 each	2 x F11	95	1.8 each

1): for SD provided
2): Order converter with auxiliary function W1, augmented BR connection

Tab.: 10-3 Technical data for SD 6 %, 15 %, 25 %

Note: If 2 resistors are specified for one position (2 x), these are to be switched parallel up to converter power code 200. Converters with power codes 315 and 400 have two brake choppers each. Depending on the power, the braking resistors are distributed either in one housing in two separate groups or in two housings. In each case, the two resistors are connected to the converter with separate lines.

Table for SD 40 %, 60 %

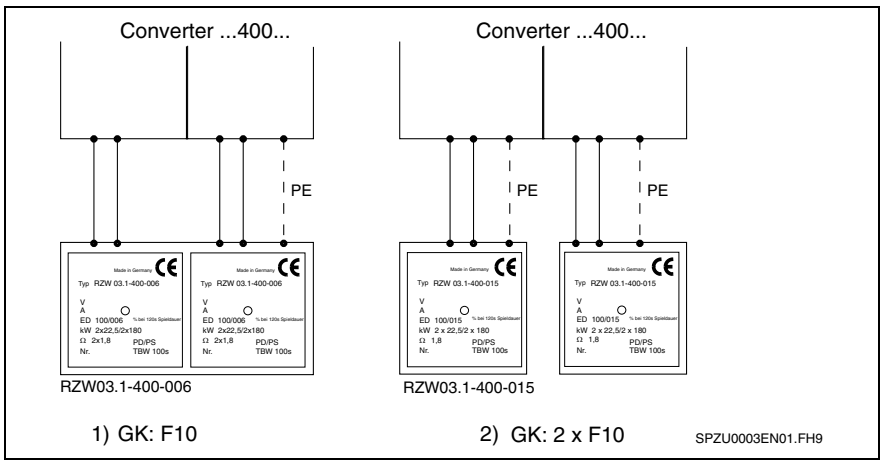
Power class	Min. connectable resistance value, W	Peak power[1] kW	SD 40 %			SD 60 %		
			Type	Cross-section, mm²	Resistance, Ω	Type	Cross-section, mm²	Resistance, Ω
001	30	1.3	E1	2.5	120	E1	2.5	120
003	30	2.7	E2	2.5	68	E3	2.5	68
004	30	3.5	E3	2.5	47	E3	2.5	47
005	30	5	E3	2.5	47	F1	2.5	42
007	30	6.5	F1	2.5	33	F1	2.5	33
011	20	10	F1	4	22	F2	6	23
015 / 018	17.5	13.5	F1	10	18	F2	10	18
022	11.6	20	F2	10	13	F3	16	13
030	8.75	27	F3	16	10	F4	25	11
037	7	33	F3	25	8.1	F7	35	7.2
045	6	40	F4	35	6.7	F7	50	7
055	5	50	F6	50	5.5	F8	50	5.4
075	3.75	67	F7	50	5	F10	70	5.3
090	2.5	81	F8	70	3.7	F11	70	3.9
110	2.5	100	F10	70	2.7	2 x F9 [3]	2 x 50	5.4
132 [2]	2.2	119	F11	95	2.3	2 x F10	2 x 50	4.4 each
160 [2]	2.2	144	2 x F7	95	4.8 each	2 x F11	2 x 50	4.8 each
200 [2]	1.6	180	2 x F8	2 x 50	3.5 each	G1 [4]	2 x 70	1.8
315 [2]	2 x 2.2	280	G1	95	2 x 2.4	G2	2 x 50	2 x 2.0
400 [2]	2 x 1.6	2 x 180	G1	95	2 x 2.1	G2 [5]	2 x 70	2 x 2.0

1): for SD provided
2): Order converter with auxiliary function W1, augmented BR connection
3): $P_{contin.}$ = 55 kW
4): $P_{contin.}$ = 100 kW
5): $P_{contin.}$ = 2 x 100 kW

Tab.: 10-4 Technical data for SD 40 %, 60 %

Note: If 2 resistors are specified for one position (2 x), these are to be switched parallel up to converter power code 200. Converters with power codes 315 and 400 have two brake choppers each. Depending on the power, the braking resistors are distributed either in one housing in two separate groups or in two housings. In each case, the two resistors are connected to the converter with separate lines.

Connection



1): Connecting 2 resistor groups in one housing
2): Connecting resistors in two housings

Fig.: 10-2 Sample connection with separate lines

Line Cross-Section

The cross-section of the grounded conductor must be at least 10 mm² (AWG 10) (if the cable cross-sections of the power lines are >10mm² (AWG 10), the grounded conductor must be at least as large).

Requirements for Line Layout

- The cross-sections apply for one phase each for multiwire conductors and are specified according to VDE0298 regulations.
- Up to 50 mm² (AWG 1/0), single wires in a cable duct
- As of 70 mm² (AWG 2/0), free contact-free layout on cable tray

Type Label

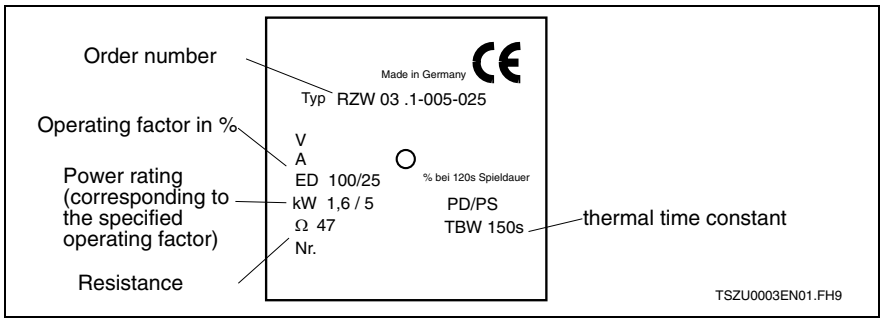


Fig.: 10-3 Type label

1. example for setting parameters:

Parameter	Parameter name	Parameter value
P0623	Resistance	47.0 Ω
P0624	Power	1.6 kW (value for 100 % SD)
P0625	Thermal time constant	150.0 s

Tab.: 10-5 1. example for setting parameters

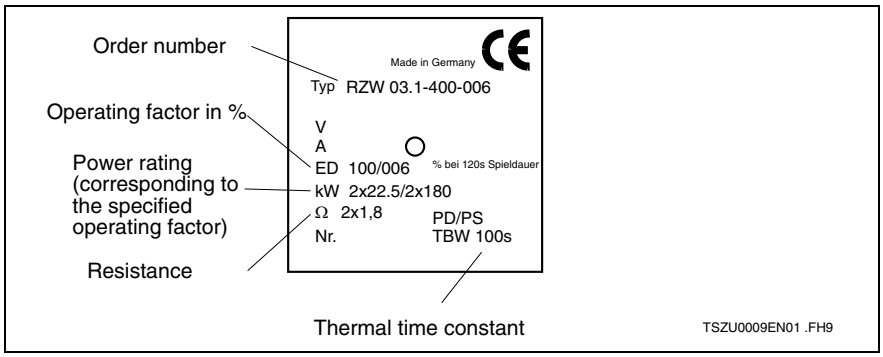


Fig.: 10-4 Type labels RZW03.1-400-006

2. example for setting parameters:

Parameter	Parameter name	Parameter value
P0623	Resistance	1.8 Ω
P0624	Power	22.5 kW (value for 100 % SD)
P0625	Thermal time constant	100.0 s

Tab.: 10-6 2. example for setting parameters

Note: If 2 resistors or 2 resistor groups are connected (i.e. in power class 160 kW at 40 % ED or in power classes 315 kW and 400 kW), the values of **one** resistor group / **one** resistor are to be entered in parameters P0623 – P0625.

10.2 Operation

Warning

WARNING

Burns due to hot components with temperatures above 30 °C!

⇒ In operation, the braking resistors heat up according to the braking power. This can heat the surface of the housing up to 80 °C.

⇒ Personnel that work on the open switch cabinet or in the switching space must note that the braking resistors are exposed.

Settings on Converter

Before the braking resistor is commissioned, the following settings must be made on the device to ensure that the braking resistor is monitored with the correct thermal portrayal during operation.

Parameter number	Parameter name	Parameter value
P0623	Resistance value	Can be found on type label; see section 10.1
P0624	Continuous power of connected resistor	Can be found on type label; see section 10.1
P0625	Thermal time constant	Can be found on type label; see section 10.1
P0036	Externally programmable	

Tab.: 10-7 Affected parameters

Malfunction During Braking Operation

When the limit values for the thermal portrayal of the braking resistors is exceeded, the converter shuts down with error „BR overload“ to protect the braking resistor from being overloaded.

Possible cause of error	Remedy
P0036	Externally programmable
Incorrect braking resistor connected.	Check whether the correct braking resistor is connected; see section 10.1.
Descending ramp too fast	Set a longer descent time.
The resistance is too high due to a defect.	Check the resistance with a suitable measuring instrument; see section 10.1.
Parameters P0623 –P0625 set incorrectly	Check the parameter setting

Tab.: 10-8 Causes of errors

10.3 Mechanical Assembly

Storage and Setup Location

Storage

The devices must be stored in clean, dry spaces. The storage temperature may be between –25 °C and +70 °C.

Minimum requirements for the setup location

- The operating area should be dust-free. Air containing dust must be filtered.
- The ambient temperature must range between 0 ... 40 °C.
- The relative humidity must not exceed 90 % (noncondensing).
- The supplied air must not contain any aggressive or electrically conducting gases that may endanger functioning of the device.
- The air current must not be impeded. The minimum free spaces specified for the supply air and exhaust air for each size class must not be restricted by auxiliary add-ons.
- The device causes power loss and heats the surroundings. Therefore, a sufficient spacing from heat-sensitive devices must be ensured.

Dimension Drawings

Fixed Resistor, IP 23, Type E

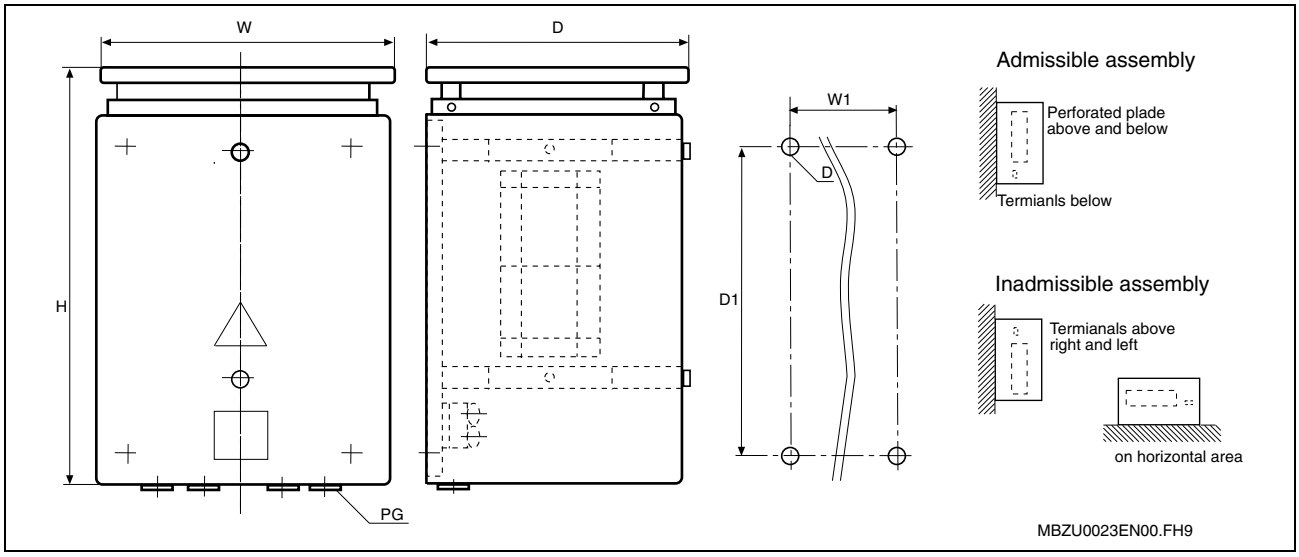


Fig.: 10-5 Type E

Type	Dimensions, mm						Weight, kg
	W	D	H	W1	D1	D	
E1	190	180	270	155	210	M5	5
E2	230	182	335	165	270	M5	7
E3	290	200	480	220	370	M8	15
E11	190	130	270	155	210	M5	3

Tab.: 10-9 Table of dimensions for braking resistor type E

Fixed Resistor, IP 23, Type F

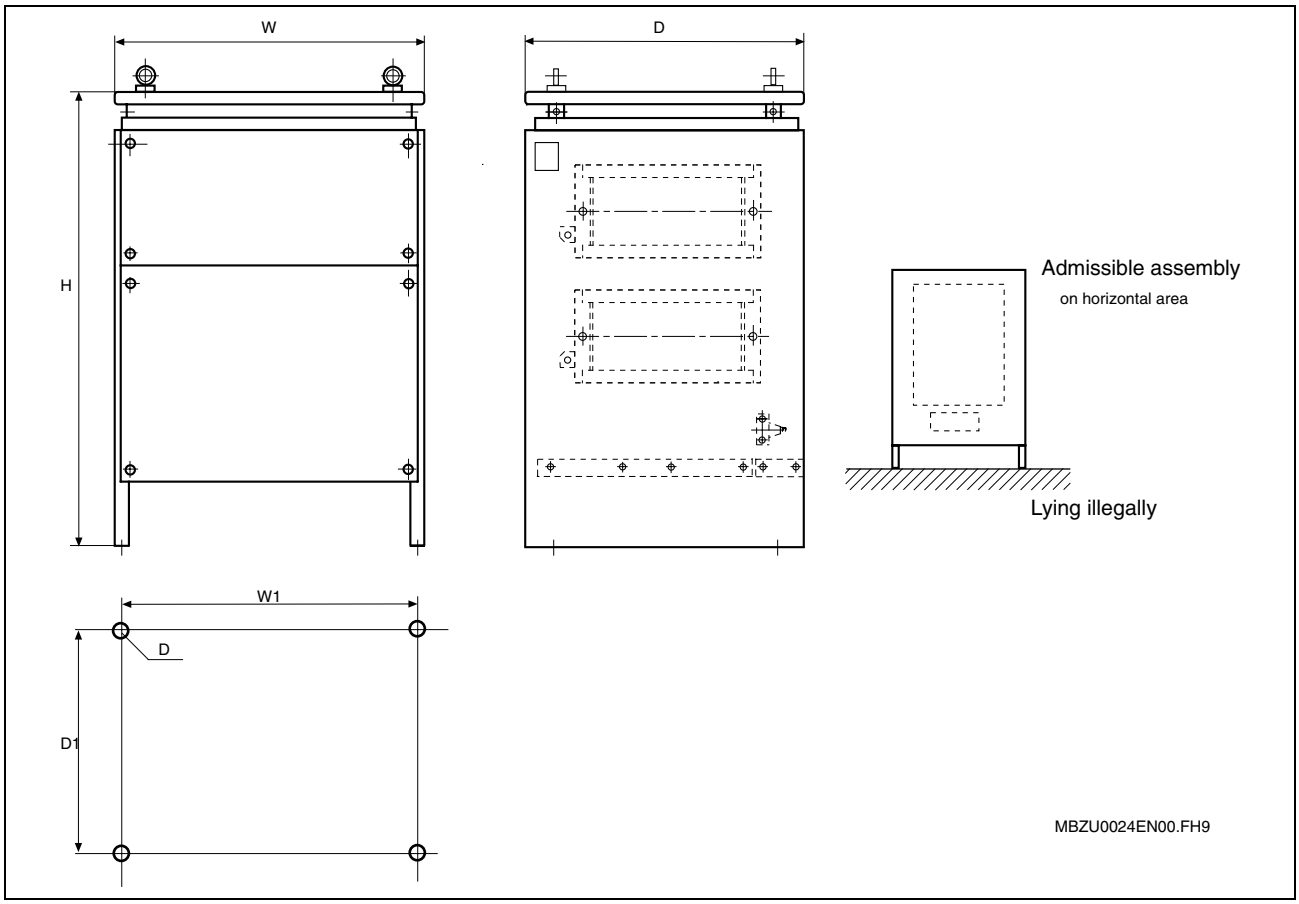


Fig.: 10-6 Type F

Type	Dimensions, mm						Weight, kg
	W	D	H	W1	D1	D	
F1	395	490	520	370	380	M10	26
F2	595	490	520	570	380	M10	36
F3	795	490	520	770	380	M10	51
F4	995	490	520	970	380	M10	61
F5	395	490	770	370	380	M10	41
F6	595	490	770	570	380	M10	61
F7	795	490	770	770	380	M10	86
F8	995	490	770	970	380	M10	101
F9	595	490	1100	570	380	M10	82
F10	795	490	1100	770	380	M10	112
F11	995	490	1100	970	380	M10	138

Tab.: 10-10 Table of dimensions for braking resistor type F

Fixed Resistor, IP 23, Type G

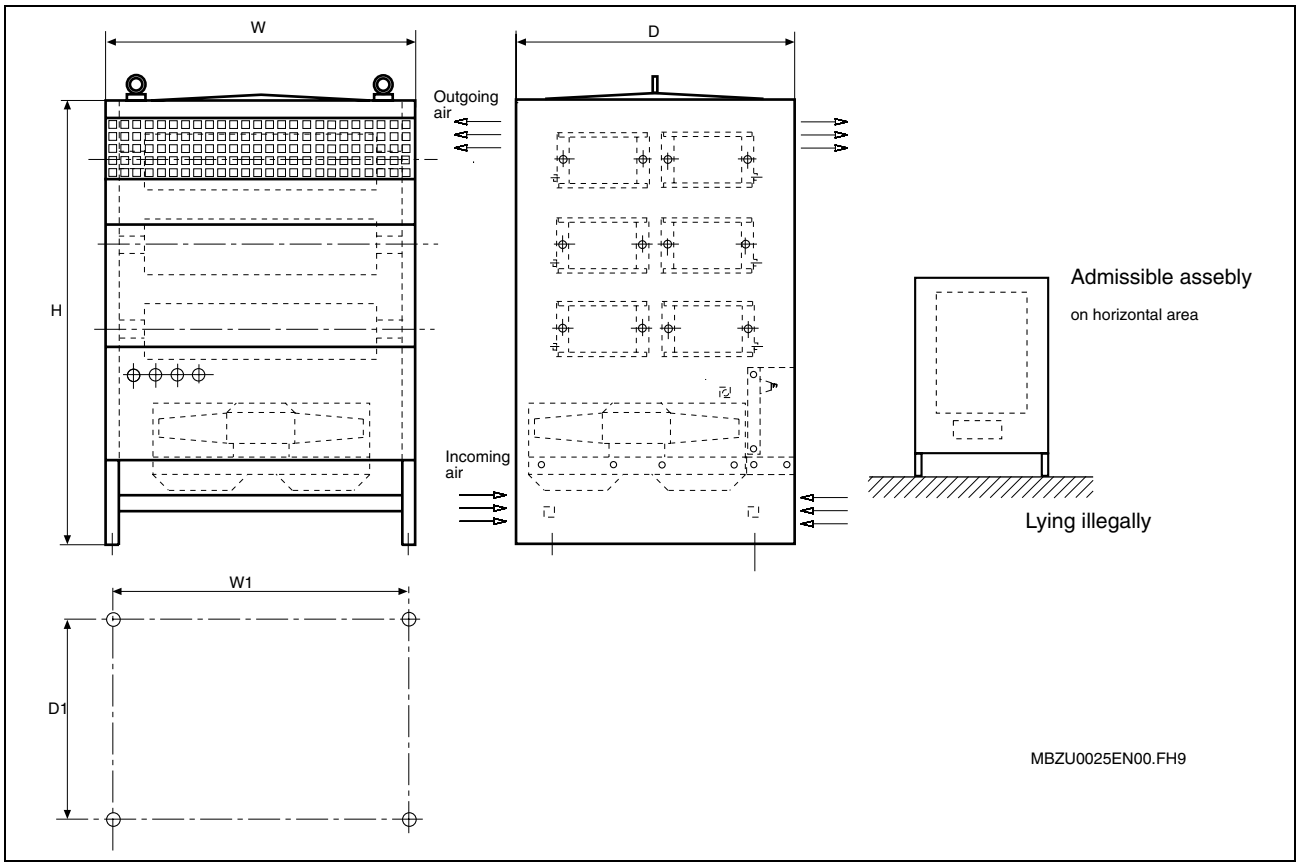


Fig.: 10-7 Type G

Type	Dimensions, mm						Weight, kg
	W	D	H	W1	D1	D	
G1	995	955	1435	970	850	M12	275
G2	995	955	1700	970	850	M12	380

Tab.: 10-11 Table of dimensions for braking resistor type G

11 Service & Support

11.1 Helpdesk

Unser Kundendienst-Helpdesk im Hauptwerk Lohr am Main steht Ihnen mit Rat und Tat zur Seite. Sie erreichen uns

Our service helpdesk at our headquarters in Lohr am Main, Germany can assist you in all kinds of inquiries. Contact us

- telefonisch - by phone: **+49 (0) 9352 40 50 60**
  über Service Call Entry Center Mo-Fr 07:00-18:00
  - via Service Call Entry Center Mo-Fr 7:00 am - 6:00 pm
- per Fax - by fax: **+49 (0) 9352 40 49 41**
- per e-Mail - by e-mail: **service.svc@boschrexroth.de**

11.2 Service-Hotline

Außerhalb der Helpdesk-Zeiten ist der Service direkt ansprechbar unter

After helpdesk hours, contact our service department directly at

+49 (0) 171 333 88 26

oder - or **+49 (0) 172 660 04 06**

11.3 Internet

Unter **www.boschrexroth.com** finden Sie ergänzende Hinweise zu Service, Reparatur und Training sowie die **aktuellen** Adressen *) unserer auf den folgenden Seiten aufgeführten Vertriebs- und Servicebüros.

- Verkaufsniederlassungen
- Niederlassungen mit Kundendienst

Außerhalb Deutschlands nehmen Sie bitte zuerst Kontakt mit unserem für Sie nächstgelegenen Ansprechpartner auf.

*) Die Angaben in der vorliegenden Dokumentation können seit Drucklegung überholt sein.

At **www.boschrexroth.com** you may find additional notes about service, repairs and training in the Internet, as well as the **actual** addresses *) of our sales- and service facilities figuring on the following pages.

- sales agencies
- offices providing service

Please contact our sales / service office in your area first.

*) Data in the present documentation may have become obsolete since printing.

11.4 Vor der Kontaktaufnahme... - Before contacting us...

Wir können Ihnen schnell und effizient helfen wenn Sie folgende Informationen bereithalten:

1. detaillierte Beschreibung der Störung und der Umstände.
2. Angaben auf dem Typenschild der betreffenden Produkte, insbesondere Typenschlüssel und Seriennummern.
3. Tel.-/Faxnummern und e-Mail-Adresse, unter denen Sie für Rückfragen zu erreichen sind.

For quick and efficient help, please have the following information ready:

1. Detailed description of the failure and circumstances.
2. Information on the type plate of the affected products, especially type codes and serial numbers.
3. Your phone/fax numbers and e-mail address, so we can contact you in case of questions.

11.5 Kundenbetreuungsstellen - Sales & Service Facilities

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